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THE RESOURCES AGENCY

Department of Water Resources

BULLETIN No. 121

SOUTHERN LAHONTAN AREA LAND AND WATER USE SURVEY 1961

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AUGUST 1965

HUGO FISHER
Administrator
The Resources Agency

EDMUND G. BROWN
Governor
State of California

WILLIAM E. WARNE
Director
Department of Water Resources



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ARTMENT OF WATER RESOURCES

BOX 388
MENTO

June 16, 1965

Honorable Edmund G. Brown, Governor, and
Members of the Legislature of the
State of California

Gentlemen:

Bulletin No. 121, "Southern Lahontan Area Land and Water Use Survey, 1961", was prepared as a part of the Department of Water Resources' continuing program of studies, pursuant to Sections 225, 226, and 232 of the California Water Code.

Portions of Mono, San Bernardino, Kern, and Los Angeles Counties, and all of Inyo County were surveyed during the investigation. For the northern portion of the area, changes in land and water use since 1950, the year of the previous survey, are evaluated in the report. For the southern portion of the area, changes in land and water use since 1957 are evaluated.

The investigation found that during the 11-year period between 1950 and 1961, the water service area in the northern portion of the study area decreased about 30 percent, and the net water use decreased about 50 percent, or approximately 14,100 acre-feet. In the southern portion of the area, the water service area increased about 64 percent between 1957 and 1961, and the net water use increased about 38,500 acre-feet, or 20 percent.

The increasing need for water in the desert areas of Southern California, coupled with already deficient local water supplies in many localities, points up the need for continued participation by residents of this area in statewide planning and construction of water resources developments.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "W. E. Warne", written over a horizontal line.

Director

AUTHORIZATION

The California Legislature of 1929 enacted legislation, providing for investigations of the kind reported here, as follows:

"SECTION 1. Out of any money in the State treasury not otherwise appropriated, the sum of four hundred fifty thousand dollars,* or so much thereof as may be necessary, is hereby appropriated to be expended by the State Department of Public Works in accordance with law in conducting work of exploration, investigation and preliminary plans in furtherance of a coordinated plan for the conservation, development, and utilization of the water resources of California including the Santa Ana River and its tributaries, the Mojave River and its tributaries, and all other water resources of Southern California."
(California Statutes of 1929, Chapter 832, Section 1)

Subsequent sessions of the Legislature have appropriated funds for support of programs of the Department of Water Resources. Portions of these funds have been utilized for continuing investigations of the water resources of Southern California in accordance with the legislative intent expressed in the foregoing statute and in Sections 225 and 226 of the California Water Code.

The Department of Water Resources was directed by the Legislature in 1956 to make continuing investigations to develop "information as to water which can be made available for exportation from the watersheds from which it originates without depriving those watersheds of water resources for beneficial uses therein". This legislation specifically requested investigation of and reports on the following matters:

"(a) The boundaries of the respective watersheds of the State and the quantities of water originating therein; (b) The quantities of water reasonably required for ultimate beneficial use in the respective watersheds; (c) The quantities of water, if any, available for export from the respective watersheds;

*Reduced by the Governor to \$390,000.

(d) The areas which can be served by the water available for export from each watershed; and (e) The present uses of water within each watershed together with the apparent claim of water right attaching thereto, excluding individual uses of water involving diversions of small quantities which, in the judgment of the Director of Water Resources, are insufficient in the aggregate to materially affect the quantitative determinations included in the report."

Pursuant to the foregoing legislation, the Department of Water Resources began a program of continuing surveys of land and water use in the water-deficient Southern California area during 1957. Surveys are made in portions of the entire Southern District, so that land and water use are determined at periodic intervals for every area in the District.

ACKNOWLEDGMENT

Valuable assistance and data used in this investigation and report were contributed by public and private agencies. The cooperation and assistance received from these agencies is gratefully acknowledged. Special mention is made of the assistance and cooperation received from the following:

Los Angeles County Director and Farm Advisor

Los Angeles Department of Water and Power

Los Angeles County Engineer's Office

California Division of Highways

Inyo County Administrator

United States Forest Service

California Department of Fish and Game

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

EDMUND G. BROWN, Governor, State of California
HUGO FISHER, Administrator, The Resources Agency
WILLIAM E. WARNE, Director, Department of Water Resources
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CHAPTER I. INTRODUCTION

Water is the essential ingredient that transforms dry wastelands into productive property, useful for agriculture, urban growth, industry, and recreation. Once a practical, economical method of obtaining water is found, agricultural, urban, and industrial growth can take place.

Certain parts of the southern Lahontan area are thus being changed from desert land to productive land, and the resulting influx of population and industry has brought a rapid expansion of the small communities. This is especially true of those communities located close to the large population centers of Southern California.

Recognizing the rapid change that is taking place in land use within the water-deficient areas of Southern California, the State Legislature has authorized the Department of Water Resources to make continuing surveys of land and water use throughout the area. This bulletin is one in a series that presents results of the surveys made during 1961. It gives information on the rate of growth and development and the increasing need for water development in the southern Lahontan area of California under conditions that existed in the summer of 1961.

Objective and Scope of Investigation

The objective of this investigation is to develop information on which present and future water requirements can be established.

Land use information provides basic data from which present water requirements can be computed. A knowledge of historical growth patterns of land use not only permits such computations but, of more importance to the overall planning concept, permits an analysis of the direction and



ANTELOPE VALLEY

Spence Air Photos

Water is the essential ingredient that transforms dry, barren areas into productive land, useful for such things as agriculture.

magnitude of land use changes taking place from one survey to another. This information, coupled with computations of changes in water use, provides the basis upon which future water requirements are determined, and upon which the planning for importation and distribution systems is carried out. The material presented here is intended for the use of agencies responsible for making the most effective use of existing water supplies and for developing additional supplies to meet current and expected deficiencies.

Present land use was determined from an extensive field survey of the southern Lahontan area of California conducted during the summer of 1961. The area surveyed is shown on Plate 1, "Area of Investigation and Hydrographic Units".

In addition to showing present land use, this report also presents a narration of historical land use development and an estimate of the present levels of water use. Results of previous land use studies conducted for California State Water Resources Board, Bulletin No. 2, "Water Utilization and Requirements of California", June 1955, and California State Department of Water Resources, Bulletin No. 101, "Desert Areas of Southeastern California Land and Water Use Survey, 1958", January 1963, served as the basis for comparison between historical and present land use determinations. Information on local water supplies was obtained from material in the Department's files and from operating agencies in the area of investigation.

Terms used in this report that require clarification are defined at the point where they first occur in the text, and are supplemented by a list of definitions, presented in Appendix A.

Land use information collected by the Department of Water Resources is processed by machine techniques which permit the evaluation of these data in terms of a sizable number of hydrologic, geographic, or political subdivisions with different boundaries. The tabulations in the main body of this report give land use within the boundaries that are thought to be the most generally useful. Additional land use tabulations for hydrologic units, subunits, and subareas are given in Appendix B. The boundaries of these areas are shown on Plate 2, "Hydrologic Units, Subunits, and Subareas". Appendix C contains a list of districts, areas, and units for which individual tabulations of 1961 land uses can be obtained by machine methods, based on data available in the Department's files.

Related Investigations and Reports

The California Legislature of 1947, by Chapter 1541, Statutes of 1947, appropriated funds for predecessor agencies and the Department of Water Resources to conduct a comprehensive investigation of the water resources of the entire State of California. The investigation had as its purpose the preparation of The California Water Plan. Results of the investigation are contained in three publications: California State Water Resources Board Bulletin No. 1, "Water Resources of California", 1951; California State Water Resources Board Bulletin No. 2, "Water Utilization and Requirements of California", June 1955; and California State Department of Water Resources Bulletin No. 3, "The California Water Plan", May 1957. The investigations for Bulletin No. 2 included a survey of land use and a determination of water utilization in the southern Lahontan area for 1950. More recent land and water use information was published in Bulletin No. 101, entitled "Desert Areas of Southeastern California Land and Water

Use Survey, 1958". This bulletin presents 1957 land and water use data for the Antelope Valley, Southern Death Valley, and Mojave River Hydrographic Units, and 1958 data for the remainder of the southeastern desert area. The 1957 information was used extensively in this bulletin for comparison purposes.

The following reports also contain information pertinent to land and water use within the southern Lahontan area:

Blaney, Harry F. and Ewing, Paul A. "Utilization of the Waters of Mojave River, California." United States Department of Agriculture. August 1935.

California State Department of Engineering. "Report on the Utilization of Mojave River for Irrigation in Victor Valley, California." Bulletin No. 5. 1918.

California State Department of Public Works, Division of Water Resources. "Mojave River Investigation." Bulletin No. 47. 1934.

----. "Report on Senate Committee on Local Governmental Agencies on Water Supply and Use of Water in Mono-Inyo Basin, California, Pursuant to Committee Resolution Adopted November 25, 1947." March 1948.

Conkling, Harold. "Report on Owens Valley Project, California." Department of the Interior, United States Reclamation Service. September 1921.

Lee, Charles. "An Intensive Study of the Water Resources of a Part of Owens Valley, California." United States Department of the Interior, Geological Survey. Water Supply Paper 294. 1912.

CHAPTER II. AREA OF INVESTIGATION

The area of investigation consists generally of the territory between the Nevada-California state line on the northeast, and the Sierra Nevada and Tehachapi Mountains on the west. The southern boundary is the drainage divide of the San Gabriel, San Bernardino, Providence, and New York Mountains. The area, which is shown on Plate 1, extends about 300 miles from the drainage divide north of Mono Lake, to the Providence and New York Mountains on the south. Included in the 26,669-square mile area of investigation are portions of Mono, San Bernardino, Kern, and Los Angeles Counties, and all of Inyo County.

This chapter gives information on the climate, cultural development, and water supply of the area as a whole, and also presents a brief description of each of the hydrographic units contained in the area of investigation.

Climatic Conditions

The southern Lahontan area is a region of broad desert valleys occasionally interspersed with and separated by barren mountain ranges. Climatic conditions vary widely with topography and latitude, but are generally characterized by light rainfall with extreme changes in seasonal and day-to-night temperatures. Summer daytime temperatures are high except at high elevations in the mountains, and winter temperatures below 32° F. are common in the high mountains and frequently occur over much of the area.

Annual rainfall varies from about 2 to 7 inches in the desert valleys, while the mountain and upper desert areas experience greater



OWENS VALLEY

Josef Muench

Annual rainfall varies from about two to six inches in the desert valleys,
while the mountains experience greater amounts of precipitation in the
form of snow.

amounts of precipitation in the form of snow. This precipitation, although extremely light and sporadic over much of the area, is the major source of ground water replenishment. Typical mean seasonal depths of precipitation in desert valleys are 6.1 inches at Bishop, 1.6 inches at Greenland Ranch in Death Valley, 4.7 inches at Independence, 4.9 inches at Mojave, 7.6 inches at Lancaster, 4.1 inches at Barstow, and 5.5 inches at Victorville. Mountain areas, such as Lake Sabrina in the Sierra Nevada west of Bishop and Big Pines Park in the San Gabriel Mountains, experienced a mean seasonal precipitation of 16.1 inches and 25.6 inches, respectively, during the period from 1897-98 to 1946-47. Generally, precipitation occurs from November through April for the entire area.

Cultural Development

The barren, semiarid character of the southern Lahontan area has greatly limited cultural development. It is mainly confined to valley areas where ground water supplies are available.

Irrigated agriculture is the primary economic activity throughout much of the area. Relatively large acreages are irrigated in Antelope and Mojave River Valleys by the use of ground water. Crops planted to the largest acreages are alfalfa, pasture, and field crops. The raising of livestock is a secondary agricultural activity in the Lahontan region and is usually undertaken in areas where irrigation is impractical.

In Mono Lake and Owens River Units, a substantial part of the habitable land is owned outright by either the United States or the City of Los Angeles, and practically all federal land is withdrawn from public entry for protection of the water supply of the City of Los Angeles.

However, much of the federal land is open to mineral entry, grazing, and recreation. The City of Los Angeles leases substantial acreages to agricultural operators, and a large percentage of the land owned by the City is open to hunting, fishing, and hiking, thus making the area one of the State's finest recreational areas. During years when water supplies in the two basins are more than sufficient to meet the City's exportation requirements, the City makes water available for irrigation of leased lands. In addition, during wet years the City spreads excess water over the land surface, thereby supporting the growth of native grasses. During dry years, little or no water is available for irrigation of leased lands or for spreading. The survey period occurred during a dry year and no water was spread on surrounding agricultural lands, so the acreage of irrigated agriculture reported for Owens River and Mono Lake Units reflect the minimum irrigated area.

Mining is the major industry in the southern Lahontan region. Mineral deposits, including saline deposits in dry lakebeds, constitute the majority of extracted materials. Many of these minerals have fluctuating market prices, hence, much of the mining tends to be sporadic. Gravel and limestone deposits, which provide the raw materials for more stable forms of mining, are also located in the territory.

Recent increases in industrial and recreational activities have resulted in increased population in many urban areas. Table 1 shows population in 1940, 1950, and 1960 in three principal cities as well as four unincorporated urban centers. The unincorporated urban centers do not have fixed boundaries, thus population figures over the years are not entirely comparable. Population for the portion of each county

contained within the southern Lahontan area for the years 1940, 1950, and 1960 is shown in Table 2.

TABLE 1

POPULATION OF PRINCIPAL URBAN CENTERS IN
SOUTHERN LAHONTAN AREA

City	1940	1950	1960
Barstow	2,100	6,100	11,600
Bishop	1,500	2,900	2,900
Lancaster*	2,100	3,600	26,000
Lone Pine*	--	1,400	1,300
Mojave*	1,200	2,100	1,800
Trona*	--	2,500	1,100
Victorville	2,000	3,200	8,200

*Unincorporated area.

TABLE 2

POPULATION OF COUNTIES OR PORTIONS OF COUNTIES
WITHIN SOUTHERN LAHONTAN AREA

County	1940	1950	1960
Inyo	7,600	11,700	11,700
Kern*	1,500	11,500	36,700
Los Angeles*	7,700	16,100	68,200
Mono*	1,400	1,400	1,400
San Bernardino*	<u>11,900</u>	<u>30,300</u>	<u>59,000</u>
TOTALS	30,100	71,000	177,000

*Estimated.

Many recreation areas, centered around lakes and streams, have been and are still being developed and utilized in the southern Lahontan area. The majority of these areas are located in the northern region, primarily in the Mono Lake and Owens Valley areas. Principal recreational activities are fishing, hunting, boating, camping, and water sports.

Water Supply

When a winter storm passes over the eastern part of California dropping snow on the rugged High Sierra, rainfall pelts the desert slopes of the San Gabriel and San Bernardino Mountains. Creeks fill and converge with larger streams on the valley floor. Some of the runoff continues over long distances, but much of it disappears underground to vast subsurface reserves. The intermittent stream is a characteristic of the Lahontan area, with the exception of a few perennial streams in Mono Basin and Owens River Valley.

During the summer, a flash flood may momentarily fill desert arroyos with torrents of water, tumbling huge boulders in paths of destruction; but this product of the summer thunderstorm evaporates quickly under the intense heat of the desert sun, and adds little to the overall water supply.

The development of water supplies has been influenced to a large extent by the growth patterns of urban land uses and irrigated agriculture. Three areas that have been affected by accelerated land use changes are Antelope Valley, Mojave River, and Mono-Owens River areas.

The Antelope Valley area relies to a large extent on ground water extractions, which in 1960 amounted to an estimated 307,000 acre-feet. Though the storage capacity is great, ground water levels throughout the Antelope Basin have been dropping over the past 30 years. Continuous overdraft has caused some water tables to drop as much as 120 feet during the past 20 years. The need for imported water to meet overdraft conditions and to provide for future growth requirements led to the formation of the Antelope Valley-East Kern Water Agency. The safe yield of local water

supplies within the agency boundary has been estimated to be 60,000 acre-feet per year. Overdraft in this same area is estimated to be 93,500 acre-feet per year. To alleviate the water shortage, this Agency has contracted for a maximum entitlement of 138,400 acre-feet annually of state project water to be delivered beginning in 1972.

Local water supplies in the Mojave River area are surface flow at several locations along the river and ground water basins. Water levels are gradually dropping, particularly in the Upper, Middle, and Lower Mojave Hydrologic Subunits where the Department estimates local water supplies to be about 73,000 acre-feet per year. The deficiency in this area was approaching 35,000 acre-feet annually by 1961. The Mojave Water Agency was formed in 1959 to provide for future water needs, and has contracted for a maximum delivery of 50,800 acre-feet of water annually from the California Aqueduct with deliveries to begin in 1972.

Other water service agencies contracting for state project water are the Palmdale Irrigation District (17,300 acre-feet annually), Crestline-Lake Arrowhead Water Agency (5,800 acre-feet annually), and the Littlerock Creek Irrigation District (2,300 acre-feet annually).

The Mono and Owens River areas contain large ground water reserves supplied by a seasonal natural runoff which has been estimated to be 726,000 acre-feet per year. A portion of this water is exported to the south coastal area by the City of Los Angeles through the Los Angeles Aqueduct. Water is diverted from Mono Basin and conveyed through tunnels to the headwaters of the Owens River. Water is then diverted into the aqueduct from the Owens River at a point about 15 miles south of Big Pine and is transported 233 miles through conduit to the City of Los Angeles.

This export has amounted to about 342,000 acre-feet per year, the present capacity of the aqueduct. The City of Los Angeles has announced plans to export an additional 152,000 acre-feet of water per year through a proposed second barrel of the Los Angeles Aqueduct.

Hydrographic Units

To facilitate hydrographic analyses, the southern Lahontan Hydrographic Area was divided into six hydrographic units, based on consideration of surface drainage, cultural development, and the geology of ground water occurrence. These units and their numerical designations are: Mono Lake (6-7), Adobe Valley (6-8), Owens River (6-9), Death Valley (6-10), Mojave River (6-11), and Antelope Valley (6-12). Table 3 lists the gross area of each of the hydrographic units.

TABLE 3

AREAS OF HYDROGRAPHIC UNITS, SOUTHERN LAHONTAN AREA

Hydrographic unit		Acres
	:	
	:	
Mono Lake	(6-7)	429,000
Adobe Valley	(6-8)	188,000
Owens River	(6-9)	2,005,000
Death Valley	(6-10)	9,858,000
Mojave River	(6-11)	3,064,000
Antelope Valley	(6-12)	<u>1,524,000</u>
TOTAL		17,068,000

The remaining portion of this chapter presents a brief description of the physiography and cultural development of each hydrographic unit.

Mono Lake Unit (6-7)

The Mono Lake Hydrographic Unit, as shown on Plate 1, is a nearly rectangular area located at the very northernmost part of the

investigational area and is bounded on the west by the rugged Sierra Nevada and on the east by the California-Nevada state line.

Mono Lake, covering an area of 86 square miles and reaching a maximum depth of 150 feet, is the major feature of the area. The waters of this lake are unsuitable for general use due to the large mineral content, which is considerably in excess of that of the Pacific Ocean.

The original industry in the area was mining which began in the 1860's, although some ranching was also attempted at that time. The mining boom eventually subsided and population in the area declined rapidly.

At present, the Federal Government has withdrawn a large percentage of the land to protect the water supply of the City of Los Angeles, which has built storage reservoirs and stream diversion facilities in the area.

Recreational use of the lakes and streams is a major activity in the area. The numerous lakes receive the heaviest recreational demand for fishing, hiking, camping, and water sports.

Adobe Valley Unit (6-8)

The Adobe Valley Unit is a small irregular-shaped area southeast of the Mono Lake Unit as shown on Plate 1. The unit is bounded on the north by the California-Nevada border, on the east by the Benton Range, on the south by the drainage boundary running through Glass Mountain, and on the west by the Cowtrack Mountain Divide. The bordering mountains range in elevation from 7,100 to 11,100 feet.

Development of ground water supply in the basin area has been limited because most of the land is in federal ownership, and therefore withdrawn from entry. For this reason, cattle raising has become the

major industry. The northeast and southwest portions of the basin constitute a part of the Inyo National Forest and are thus unavailable for private use.

Owens River Unit (6-9)

The Owens River Unit, consisting of approximately 3,100 square miles, is a long, narrow area bordered on the north by the Mono Lake and Adobe Valley Units as shown on Plate 1. The southern boundary crosses the north portion of the Coso Mountains. The east boundary of the unit consists of the White and Inyo Mountains and the west boundary, the Sierra Nevada.

This hydrographic unit contains the entire deeply incised valley surrounding the Owens River. Lake Crowley, Owens Lake, and part of Haiwee Reservoir are also included in the Unit.

Recreational facilities are located extensively throughout the Owens River area and are the most rapidly developing activity. A large number of streams, lakes, and reservoirs located on the basin floor and in the Sierra Nevada foothill area are used primarily for fishing. Other activities in the area include camping, hiking, hunting, and various water sports.

Death Valley Unit (6-10)

Largest of the southern Lahontan hydrographic units is the Death Valley Unit, which contains about 15,400 square miles of desert area. The unit boundaries, as shown on Plate 1, consist of the Mojave River drainage divide and the Antelope Valley Hydrographic Unit on the south, the California-Nevada state line on the northeast, and the drainage divide of the Tehachapi, Sierra Nevada, Inyo and White Mountains on the west.

Within the unit there are limited farming and grazing. Industrial activity is centered around the mining of saline deposits, but the most noteworthy feature of this unit is the popularity of Death Valley as a winter recreational center. Close to 400,000 vacationers visited the area during 1961.

Mojave River Unit (6-11)

The southernmost unit of the Lahontan Hydrographic Area is the Mojave River Unit. This unit, comprising 4,800 square miles, is bordered by the Death Valley Unit on the east and north and the Antelope Valley Unit on the west. The southern extent of the area, as shown on Plate 1, is terminated by the Ord, Providence and New York Mountains.

The principal water supply in the area is the ground water along the Mojave River and its tributaries. This supply has resulted in a relatively consistent development of agriculture.

Mining, consisting of sporadic extraction of minerals, is the major industry of the area; but the large cement manufacturing plants with more stable productions are a greater stimulus to growth.

Because the major portion of this territory is within relatively easy driving distance of the greater Los Angeles area, weekend recreation has become an important activity during the winter months when many people seek a weekend of rest and quiet in the mild desert climate.

Antelope Valley Unit (6-12)

The Antelope Valley Unit is a triangular-shaped area with the northern apex near Randsburg in Kern County, as shown on Plate 1. The northwest and southwest boundaries parallel the Tehachapi and San Gabriel Mountains, respectively.

Agriculture has been the most important activity in this area until recently, with about 63,900 acres devoted to irrigated farming. In the last two decades, aircraft, defense, and related industries have become increasingly more important to the economy. However, smaller industries are still generally associated with agricultural needs and developments.

This area is similar to the Mojave River Unit in that winter recreational activities have increased tremendously in the last few decades due to the warm desert climate and its proximity to the greater Los Angeles area.

CHAPTER III. LAND USE

The type, location, and areal extent of present land use within the study area were determined by a detailed land use survey conducted during the summer of 1961. The results of that survey are presented in this chapter, along with a discussion of methods and procedures used in classifying results. This chapter also presents comparisons of land use found during the present survey and during previous surveys.

Methods and Procedures

Mapping of the southern Lahontan area was initiated in July 1961 by Department field crews. All the land use types requiring applied water were delineated by the survey crews on the most recent vertical aerial photographs available, except for some isolated development east of Bishop near the Nevada state line where photos were supplemented by United States Geological Survey quadrangle maps. In the office, field delineations were transferred by projection to reproducible prints of United States Geological Survey quadrangle maps at a scale of 1 inch equals 2,000 feet. These maps served as area control maps, ensuring the accuracy of the succeeding processes, while the reproducible prints served as masters for reproducing land use delineations on vellum prints. The individual areas of land use types were cut from the vellum prints and weighed, and, by machine computation, these weights were converted into total acreages of individual land use types.

For a critical hydrologic analysis, determining and compiling all types of land use for the entire hydrographic unit would be desirable. This would permit a comprehensive analysis and evaluation of the various

levels of water use for the entire area. However, such a complete compilation is not felt to be warranted at present. Therefore, the usual practice is to map in their entirety only those areas which are underlain by water-bearing material. In those areas which are not underlain by water-bearing material, only types of land use requiring applied water are mapped. All other types of land use in areas not underlain by water-bearing material are tabulated in a category called "unclassified".

Classification of Land Use

For analysis and presentation, the various land uses were grouped into two major categories under water service areas -- urban and suburban and irrigated agriculture -- and into three major categories under nonwater service areas -- nonirrigated agriculture, native vegetation, and unclassified. Both major categories under water service areas include several classes of land use, and these several classes consist of various types of land use, grouped according to their water requirements.

The major categories, classes, and types of land use included in the classification are as given in the outline below. The classes of land use given here are similar to those used in the previously mentioned Bulletins Nos. 2 and 101, except that parks, golf courses, and cemeteries, classified as irrigated pasture in Bulletin No. 2, are included under unsegregated urban and suburban area in this report.

In delineating land use types in the field, no attempt was made to exclude such items as streets, roads, railroads, powerline rights-of-way, and other essentially nonwater-using lands occurring within the surveyed areas. Instead, these land uses were extracted from overall land

WATER SERVICE AREA

Urban and Suburban Category

<u>Class of Land Use</u>	<u>Type of Land Use</u>
Residential	Single and multiple family houses and apartments, institutions, motels, 1- and 2-story hotels, trailer parks, and residential subdivisions under construction at time of survey.
Recreational residential .	Weekend and summer home tracts within a primarily recreational area.
Commercial	All classes of commercial enterprises, including strip commercial, downtown commercial, and schools, but excluding 1- and 2-story hotels, motels, and institutions.
Industrial	All classes of industrial land uses involving manufacturing, processing, and packaging, but excluding extractive industries (oil, sand, and gravel), air fields, and storage, distribution, and transportation facilities.
Unsegregated urban and suburban area	Farmsteads, dairies, livestock ranches, parks, cemeteries, and golf courses.
Included nonwater service area	Oil fields, tank farms, vacant lots, quarries, gravel pits, warehouses and storage yards, railroads, public streets, landing strips of airfields, and subdivisions with streets and utilities in place but with no buildings constructed.

Irrigated Agriculture Category

<u>Class of Land Use</u>	<u>Type of Land Use</u>
Alfalfa	Alfalfa raised for hay, seed, or pasture.

Class of Land Use (continued)Type of Land Use

Pasture Irrigated grasses and legumes other than alfalfa used for livestock forage.

Citrus and subtropical . . Oranges, lemons, grapefruit, tangerines, avocados, dates, and olives.

Truck crops Vegetables of all varieties, melons, flower seed, and nursery crops.

Field crops Cotton, sorghum, sugar beets, and field corn.

Deciduous fruits and nuts . All varieties.

Small grains Barley, wheat, and oats.

Vineyards All varieties.

Fallow Tilled, between crops.

Included nonwater
service area Public highways and roads, farm access roads, canals, and other inclusions not devoted to crop production, including idle and abandoned lands.

NONWATER SERVICE AREAType of Land Use

Nonirrigated Agriculture Category . . All nonirrigated agriculture overlying defined ground water basins.

Native Vegetation Category Native grasses, brush, and trees, including phreatophytes, overlying defined ground water basins.

Unclassified Category Bare ground, including river washes and beaches, and water surfaces overlying defined ground water basins. Also includes nonirrigated agriculture and native vegetation not overlying defined ground water basins.

use totals by applying to each major land use class a percentage value, or reduction factor, appropriate for that class. These amounts extracted were then classified as "included nonwater service area". Reduction factors were derived by analyzing aerial photographs to determine the area in streets, roads, and rights-of-way within field delineated parcels of land use. These nonwater-using areas were then compared to the gross delineation in order to derive the reduction percent. The appropriate reduction factors for the major classes of land use are presented in Table 4. The net acreage values used in the tables summarizing land use represent the gross acreage values minus those portions of the gross values that have been deducted for these included nonwater service areas.

TABLE 4
FACTORS FOR REDUCTION OF GROSS AREAS
TO NET WATER SERVICE AREAS

Land use	: Percent deducted from gross area
Residential	20
Commercial	30
Industrial, manufacturing	25
Schools	15
Parks, cemeteries, and golf courses	15
Feedlots, dairies	10
Farmsteads	5
Irrigated agriculture	5

Many areas located within military reservations throughout the area of investigation were restricted to entry and thus could not be mapped in the field. Consequently, the land uses occurring within the boundaries of the military reservations are included in the summary tables under the category "unclassified".

Results of Land Use Survey

Important to the investigation is not only the present land use, but also the comparison of present with past land use. From these comparisons, the investigator can analyse the direction and size of land use changes. By combining these with computations in changes of water use, he can estimate future water requirements.

Present Land Use

The results of the land use survey indicate that more than 187,000 acres of land in the southern Lahontan area required water service in 1961. As shown in Table 5, which summarizes land use on the basis of hydrographic units, about 98,000 acres of this total were included in the urban and suburban classes, while more than 89,000 acres were in the irrigated agricultural classes. Table 5 also shows that about 158,000 acres, or approximately 84 percent of the total lands requiring water service, are located within two hydrographic units - the Mojave River and Antelope Valley Units.

Table 6 summarizes land use within counties in the area of investigation. Appendix B lists land use in hydrologic units, subunits, and subareas of the southern Lahontan area.

Details of the patterns of land use in the survey area are given on Plates 3A, 3B, 3C, and 3D, "Present Land Use". Although the acreages of nonwater service areas within urban and suburban and irrigated agricultural areas are shown individually on the tables in Appendix B, they were not differentiated on the plates. Also, no differentiation was made on these plates between developed nonwater service lands, such as



OPEN PIT MINING OF BORATE ORES

Spence Air Photos

The southern Lahontan area is a major supplier of borates.

TABLE 5

LAND USE IN HYDROGRAPHIC UNITS OF THE SOUTHERN LAHONTAN AREA IN 1961

In acres

Category and class of land use	Hydrographic Units						
	Mono Lake	Adobe Valley	Owens River	Death Valley	Mojave River	Antelope Valley	Totals
WATER SERVICE AREA							
Urban and Suburban							
Residential	80	0	1,160	2,100	8,030	7,280	18,650
Recreational residential	120	0	340	40	3,230	550	4,280
Commercial	30	0	300	400	930	930	2,590
Industrial	0	0	40	90	170	140	440
Unsegregated urban and suburban area	20	a	910	1,100	3,290	5,410	10,730
Subtotals	250	a	2,750	3,730	15,650	14,310	36,690
Included Nonwater Service Area	70	a	1,410	9,980	35,240	14,720	61,420
Gross Urban and Suburban Area	320	a	4,160	13,710	50,890	29,030	98,110
Irrigated Agriculture							
Alfalfa	0	0	1,380	4,220	9,490	41,320	56,410
Pasture	0	0	2,490	980	2,020	2,630	8,120
Citrus and subtropical	0	0	0	0	0	10	10
Truck crops	0	0	a	220	160	2,110	2,490
Field crops	0	0	50	250	800	2,290	3,390
Deciduous fruits and nuts	0	0	30	0	210	1,410	1,650
Small grains	0	0	0	180	50	4,890	5,120
Vineyards	0	0	0	0	0	60	60
Subtotals	0	0	3,950	5,850	12,730	54,720	77,250
Fallow	0	0	20	130	250	2,350	2,750
Included Nonwater Service Area	0	0	910	670	960	6,850	9,390
Gross Irrigated Agriculture	0	0	4,880	6,650	13,940	63,920	89,390
GROSS WATER SERVICE AREA	320	a	9,040	20,360	64,830	92,950	187,500
NONWATER SERVICE AREA							
Nonirrigated Agriculture	0	0	16,530	12,920	6,810	115,790	152,050
Native Vegetation	189,970	38,650	722,700	4,546,950	1,807,000	813,650	8,118,920
Unclassified	238,710	149,350	1,256,730	5,277,770	1,185,360	501,610	8,609,530
GROSS NONWATER SERVICE AREA	428,680	188,000	1,995,960	9,837,640	2,999,170	1,431,050	16,880,500
TOTALS	429,000	188,000	2,005,000	9,858,000	3,064,000	1,524,000	17,068,000

a. Less than five acres.

LAND USE IN COUNTIES OF THE SOUTHERN LAHONTAN AREA IN 1961

In acres

Category and class of land use	Inyo County	Kern County*	Los Angeles County*	Mono County*	San Bernardino County*	Total
WATER SERVICE AREA						
<u>Urban and Suburban</u>						
Residential	1,190	2,950	5,340	290	8,880	18,650
Recreational residential	60	80	70	400	3,670	4,280
Commercial	300	460	680	130	1,020	2,590
Industrial	40	90	70	0	240	440
Unsegregated urban and suburban area	<u>870</u>	<u>1,470</u>	<u>4,400</u>	<u>210</u>	<u>3,780</u>	<u>10,730</u>
Subtotals	2,460	5,050	10,560	1,030	17,590	36,690
Included Nonwater Service Area	<u>1,500</u>	<u>10,220</u>	<u>11,580</u>	<u>260</u>	<u>37,860</u>	<u>61,420</u>
Gross Urban and Suburban Area	3,960	15,270	22,140	1,290	55,450	98,110
<u>Irrigated Agriculture</u>						
Alfalfa	890	12,060	32,210	1,150	10,100	56,410
Pasture	2,370	820	2,090	460	2,380	8,120
Citrus and subtropical	0	0	10	0	0	10
Truck crops	40	520	1,720	0	210	2,490
Field crops	210	490	1,820	40	830	3,390
Deciduous fruits and nuts	0	10	1,390	30	220	1,650
Small grains	0	380	4,690	0	50	5,120
Vineyards	<u>0</u>	<u>0</u>	<u>60</u>	<u>0</u>	<u>0</u>	<u>60</u>
Subtotals	3,510	14,280	43,990	1,680	13,790	77,250
Fallow	0	330	2,100	20	300	2,750
Included Nonwater Service Area	<u>710</u>	<u>1,070</u>	<u>6,120</u>	<u>430</u>	<u>1,060</u>	<u>9,390</u>
Gross Irrigated Agriculture	4,220	15,680	52,210	2,130	15,150	89,390
GROSS WATER SERVICE AREA	8,180	30,950	74,350	3,420	70,600	187,500
NONWATER SERVICE AREA						
<u>Nonirrigated Agriculture</u>						
Native Vegetation	14,000	30,090	96,670	3,000	8,290	152,050
Unclassified	<u>2,702,590</u>	<u>766,810</u>	<u>362,110</u>	<u>418,900</u>	<u>3,868,510</u>	<u>8,118,920</u>
	<u>3,825,920</u>	<u>827,750</u>	<u>259,220</u>	<u>993,300</u>	<u>2,703,340</u>	<u>8,609,530</u>
GROSS NONWATER SERVICE AREA	<u>6,542,510</u>	<u>1,624,650</u>	<u>718,000</u>	<u>1,415,200</u>	<u>6,580,140</u>	<u>16,880,500</u>
TOTALS	6,550,690	1,655,600	792,350	1,418,620	6,650,740	17,068,000

*Acreages for portion of county within investigational area.

nonirrigated agriculture, and undeveloped nonwater service lands, such as native vegetation.

In the southern Lahontan area, water service to municipalities and other urban and suburban areas is provided by commercial water companies and a variety of miscellaneous public water agencies, while water developments for irrigated agriculture have been made by private individuals through the use of ground water and, to some extent, through surface water diversions. Table 7 summarizes land use within the boundaries of the two small irrigation districts in Antelope Valley. Within recent years two large water agencies were organized in the Mojave River and Antelope Valley areas expressly for contracting for imported water to be made available through the State Water Facilities. The Mojave Water Agency is located in San Bernardino County and the Antelope Valley-East Kern Water Agency is located in Los Angeles and Kern Counties. Land uses occurring within the boundaries of these agencies are also summarized in Table 7. Portions of the Mojave Water Agency and the Antelope Valley-East Kern Water Agency that fall outside the area of investigation are not included in Table 7. The boundaries of the four agencies listed in Table 7 are shown on Plates 3C and 3D.

Changes in Land Use

Major changes were found in the area requiring water service as the most recent survey that was conducted in the study area north of Kern and San Bernardino Counties was in 1950, and the last survey south of this line was in 1957.

As shown in Table 8, in the northern portion of the investigational area, the gross urban and suburban water service areas increased

TABLE 7

LAND USE IN SERVICE AREAS OF MAJOR WATER AGENCIES
OF THE SOUTHERN LAHONTAN AREA IN 1961

In acres

Category and class of land use	: Littlerock : : Creek : : Irrigation : : District :	: Palmdale : : Irrigation : : District :	: Antelope : : Valley-East : : Kern Water : : Agency :	: Mojave : : Water : : Agency :	: Total
URBAN SERVICE AREA					
Urban and Suburban					
Residential	40	850	5,650	5,910	12,450
Recreational residential	0	0	50	1,730	1,780
Commercial	30	120	730	730	1,610
Industrial	0	^a	120	150	270
Unsegregated urban and suburban area	<u>110</u>	<u>190</u>	<u>4,200</u>	<u>3,460</u>	<u>7,960</u>
Subtotals	180	1,160	10,750	11,980	24,070
Included Nonwater Service Area	<u>90</u>	<u>1,250</u>	<u>15,450</u>	<u>33,090</u>	<u>49,880</u>
Gross Urban and Suburban Area	270	2,410	26,200	45,070	73,950
IRRIGATED AGRICULTURE					
Alfalfa	30	0	43,740	10,090	53,860
Pasture	^a	10	2,470	2,300	4,780
Citrus and subtropical	^a	0	0	0	0
Truck crops	20	30	1,980	200	2,230
Field crops	0	0	2,260	830	3,090
Deciduous fruits and nuts	520	10	490	220	1,240
Small grains	0	0	4,400	50	4,450
Vineyards	<u>0</u>	<u>0</u>	<u>60</u>	<u>0</u>	<u>60</u>
Subtotals	570	50	55,400	13,690	69,710
Fallow	^a	0	2,210	300	2,510
Included Nonwater Service Area	<u>480</u>	<u>^a</u>	<u>5,660</u>	<u>1,050</u>	<u>7,190</u>
Gross Irrigated Agriculture	<u>1,050</u>	<u>50</u>	<u>63,270</u>	<u>15,040</u>	<u>79,410</u>
GROSS WATER SERVICE AREA	1,320	2,460	89,470	60,110	153,360
NONWATER SERVICE AREA					
Irrigated Agriculture	120	1,010	110,500	7,620	119,250
Native Vegetation	1,090	3,630	570,200	979,240	1,554,160
Unclassified	<u>0</u>	<u>450</u>	<u>592,900</u>	<u>1,139,000</u>	<u>1,732,350</u>
GROSS NONWATER SERVICE AREA	<u>1,210</u>	<u>5,090</u>	<u>1,273,600</u>	<u>2,125,860</u>	<u>3,405,760</u>
TOTALS	2,530	7,550	1,363,070	2,185,970	3,559,120

Less than five acres.

from about 800 acres in 1950 to 5,300 acres in 1961, while the gross agricultural water service areas decreased from about 15,600 acres in 1950 to 6,300 acres in 1961. This represents an overall decrease in gross water service area from 16,400 acres in 1950 to 11,600 acres in 1961, or about 29 percent.

In the southern portion of the area of investigation, the gross urban and suburban water service areas increased from about 17,100 acres in 1957 to 92,800 acres in 1961, however, approximately 42,800 acres of this increase consisted of subdivided land with streets and utilities in place but with no buildings constructed. The gross agricultural water service areas decreased from about 90,300 acres in 1957 to 83,100 acres in 1961. The overall gross area requiring water service increased about 64 percent from about 107,400 acres in 1957 to 175,900 acres in 1961.

The major part of the decline in irrigated agriculture occurred in Mono Lake, Adobe Valley, Owens River, and Antelope Valley Units. Changes in land use in the southern portion of the study area are delineated on Plate 4, "Change in Land Use, Antelope and Mojave River Valleys and Vicinities, 1957 to 1961". Changes in land use occurring in each hydrographic unit are discussed in the following sections.

Mono Lake Unit (6-7). The gross urban and suburban area requiring water service in the Mono Lake Unit totaled about 20 acres in 1950 and 320 acres in 1961. The gross irrigated agricultural acreage, which in 1950 was 2,100 acres planted in pasture, was discontinued by 1961 when no irrigated acreage was found.

TABLE 8

CHANGE IN LAND USE IN THE
SOUTHERN LAHONTAN AREA

In acres

Category and class of land use	Hydrographic Units in Northern Portion														
	Mono Lake			Adobe Valley			Owens River			Northern Death Valley			Totals		
	1950	1961	Change	1950	1961	Change	1950	1961	Change	1950	1961	Change	1950	1961	Change
WATER SERVICE AREA															
Urban and Suburban															
Residential	a	80	a	0	0	0	a	1,160	a	a	250	a	a	1,490	a
Recreational residential	a	120	a	0	0	0	a	340	a	a	0	a	a	460	a
Commercial	a	30	a	0	0	0	a	300	a	a	110	a	a	440	a
Industrial	a	0	a	0	0	0	a	40	a	a	0	a	a	40	a
Unsegregated urban and suburban area	a	20	a	0	b	b	a	910	a	a	140	a	a	1,070	a
Subtotals	a	250	a	0	b	b	a	2,750	a	a	500	a	a	3,500	a
Included Nonwater-Service Area	a	70	a	0	b	b	a	1,410	a	a	290	a	a	1,770	a
Gross Urban and Suburban Area	20	320	300	0	b	b	800	4,160	3,360	20	790	770	840	5,270	4,430
Irrigated Agriculture															
Alfalfa	0	0	0	0	0	0	4,800	1,380	-3,420	0	660	660	4,800	2,040	-2,760
Pasture	2,000	0	-2,000	2,300	0	-2,300	4,600	2,490	-2,110	100	320	220	9,000	2,810	-6,190
Citrus and subtropical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Truck crops	0	0	0	0	0	0	200	a	a	700	40	-	900	40	- 860
Field crops	0	0	0	0	0	0	0	50	50	0	190	190	0	240	0
Deciduous fruits and nuts	0	0	0	0	0	0	200	30	- 170	100	0	-	300	30	- 270
Small grains	0	0	0	0	0	0	100	0	- 100	0	0	0	100	0	- 100
Vineyards	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotals	2,000	0	-2,000	2,300	0	-2,300	9,900	3,950	-5,950	900	1,210	310	15,100	5,160	-9,940
Fallow	a	0	a	a	0	a	a	20	a	a	0	a	a	20	a
Included Nonwater-Service Area	100	0	- 100	100	0	- 100	200	910	710	100	220	120	500	1,130	630
Gross Irrigated Agriculture	2,100	0	-2,100	2,400	0	-2,400	10,100	4,880	-5,220	1,000	1,430	430	15,600	6,310	-9,290
GROSS WATER SERVICE AREA	2,120	320	-1,800	2,400	b	-2,400	10,900	9,040	-1,860	1,020	2,220	1,200	16,440	11,580	-4,860

CHANGE IN LAND USE IN THE
SOUTHERN LAHONTIAN AREA
(continued)

In acres

Category and class of land use	Hydrographic Units in Southern Portion									
	Southern Death Valley			Mojave River			Antelope Valley			Totals
	1957	1961	Change	1957	1961	Change	1957	1961	Change	
WATER SERVICE AREA										
Urban and Suburban										
Residential	730	1,850	1,120	1,350	8,030	6,680	3,250	7,280	4,030	5,330
Recreational residential	0	40	40	30	3,230	3,200	900	550	- 350	17,160
Commercial	130	290	160	510	930	420	890	930	40	3,820
Industrial	100	90	- 10	40	170	130	50	140	90	2,890
Unsegregated urban and suburban area	100	960	860	450	3,290	2,840	1,500	5,410	3,210	2,150
Subtotals	1,060	3,230	2,170	2,380	15,650	13,270	6,590	14,310	7,720	10,030
Included Nonwater-Service Area	1,140	9,690 ^c	8,550 ^c	1,700	35,240 ^d	33,540 ^d	4,190	14,720 ^e	10,530 ^e	7,090
Gross Urban and Suburban Area	2,200	12,920 ^c	10,720 ^c	4,140	50,890 ^d	46,750 ^d	10,780	29,030 ^e	18,250 ^e	17,120
Irrigated Agriculture										
Alfalfa	4,820	3,560	- 1,260	7,060	9,490	2,430	32,410	41,320	8,910	44,290
Pasture	370	660	290	1,960	2,020	60	5,120	2,630	- 2,490	7,450
Citrus and subtropical	0	0	0	0	0	0	0	10	10	0
Truck crops	20	180	160	130	160	30	1,290	2,110	820	1,440
Field crops	2,640	60	- 2,580	1,290	800	- 490	2,210	2,290	80	3,150
Deciduous fruits and nuts	0	0	0	90	210	120	1,540	1,410	- 130	2,990
Small grains	1,990	180	- 1,810	310	50	- 260	14,570	4,890	- 9,680	1,630
Vineyards	0	0	0	10	0	- 10	0	60	60	5,120
Subtotals	9,840	4,640	- 5,200	10,850	12,730	1,880	57,140	54,720	- 2,420	77,830
Fallow	1,400	130	- 1,270	1,030	250	- 780	5,520	2,350	- 3,170	7,950
Included Nonwater-Service Area	560	450	- 110	580	960	380	3,340	6,850	3,510	4,480
Gross Irrigated Agriculture	11,800	5,220	- 6,580	12,460	13,940	1,480	66,000	63,920	- 2,080	90,260
GROSS WATER SERVICE AREA	14,000	18,140 ^c	4,140 ^c	16,600	64,830 ^d	48,230 ^d	76,780	92,990 ^e	16,170 ^e	107,380
										175,920 ^f
										68,540 ^f

a. Value not available.

b. Less than 5 acres.

c. Includes approximately 6,000 acres of subdivisions with no buildings constructed.

d. Includes approximately 28,900 acres of subdivisions with no buildings constructed.

e. Includes approximately 7,900 acres of subdivisions with no buildings constructed.

f. Includes approximately 42,800 acres of subdivisions with no buildings constructed.

Adobe Valley Unit (6-8). The gross area requiring water service in the Adobe Valley Unit consisted in 1950 of about 2,400 acres of irrigated pasture with little or no urban and suburban acreage. In 1961, no irrigated agricultural acreage existed, and the urban and suburban acreage was found to be less than five acres.

Owens River Unit (6-9). A large increase in the gross urban and suburban area occurred in the Owens River Unit. In 1950, about 800 acres were subject to this land use, and by 1961 this acreage had increased to about 4,200. Irrigated agriculture decreased during the same period from about 10,100 acres to 4,900 acres, a decrease of about 51 percent. The largest decrease in irrigated agricultural acreage occurred in alfalfa which dropped from 4,800 acres in 1950 to about 1,400 acres in 1961. During the same period, the acreage in irrigated pasture dropped from 4,600 acres to about 2,500 acres. The acreages in alfalfa and pasture in Owens Valley are subject to wide fluctuations from year to year depending on the availability of surface water supplies, as discussed in Chapter II.

Death Valley Unit (6-10). Because the most recent land use survey in the northern portion of the Death Valley Unit (that above the Kern-San Bernardino-Inyo county line) was in 1950, and that of the southern part was in 1957, the unit has been similarly divided in the discussion that follows.

Northern Death Valley. The gross water service area in the northern part of Death Valley Unit showed an increase of about 1,200 acres during the 11-year period. Urban and suburban acreage increased

from 20 acres to about 800 acres, or 40 times, and irrigated agricultural acreage increased from 1,000 acres in 1950 to approximately 1,400 acres in 1961.

Southern Death Valley. The gross urban and suburban area in the southern part of Death Valley Unit increased about 10,700 acres, or approximately six times, between 1957 and 1961. However, a large portion of this expansion (6,000 acres) was in lands that consisted of subdivisions with streets and utilities in place, but with no buildings constructed. Irrigated agriculture decreased substantially during the same period, from 11,800 acres in 1957 to 5,200 acres in 1961, with the largest decreases being in field crops, alfalfa, and small grains.

Mojave River Unit (6-11). The Mojave River Unit experienced an increase of approximately 48,200 acres in gross water service area between 1957 and 1961. Urban and suburban acreage increased from 4,100 acres in 1957 to 50,900 acres in 1961. Of this 46,800-acre increase, 3,200 acres were classified in the recreational residential category, which consists of small buildings occupied essentially during vacations or weekends on large (2.5 acres or more) lots. In addition, 28,900 acres of the 46,800-acre increase in urban and suburban area consisted of subdivisions with no buildings constructed. The gross irrigated agricultural acreage increased from 12,500 acres in 1957 to 13,900 acres in 1961, or about 11 percent.

Antelope Valley Unit (6-12). The gross urban and suburban area requiring water service in the Antelope Valley Unit increased from about 10,800 acres in 1957 to 29,000 acres in 1961, or more than 2-1/2 times.

Approximately 7,900 acres of this 18,200-acre increase occurred in subdivisions with no buildings constructed, which are classified in the "Included nonwater service area" category. Irrigated agriculture decreased slightly during the same period, from 66,000 acres to 63,900 acres, a decrease of about 3 percent.



CHAPTER IV. WATER USE

The land areas occupied by various types of water-using developments in the southern Lahontan area were described in Chapter III. Because this land use was classified on the basis of water requirements, appropriate unit values of water use can be applied to estimate the 1961 level of water use in this area. This information is necessary so that adequate programs of water resource development can be planned and implemented to meet the needs of the future growth of the area.

This chapter defines water use, presents the methods used in estimating water use, gives the unit values of water use, and estimates 1961 net water use.

Definition of Water Use

The term "water use" is employed in the broadest sense to include all uses of water by nature under native conditions and by man-made modifications of those natural conditions. It implies the application of water to any one or all of innumerable kinds of uses, both consumptive and nonconsumptive.

Consumptive use is the utilization of water from any source in the process of vegetative growth, such as transpiration and the building of plant tissue, and the evaporation of water from the soil around the plant and foliage, as well as from water surfaces. It also includes the consumption or evaporation of water by urban and nonvegetative types of land use.

In addition to the consumptive use of water as defined above, other irrecoverable losses may also take place. These include such items

as deterioration in water quality to the point where the water is unsuitable for reuse, disposal or seepage of the unconsumed water to bodies of unsuitable quality, and disposal or seepage of the unconsumed water in such a manner as to be uneconomical of recapture for use.

In general, the water for consumptive use is obtained from two sources: natural sources, including direct precipitation and surface runoff, and, as a special case, from a high ground water table; and man-developed sources, that is, water applied through the activities of man. Water furnished from these man-developed sources is termed "applied water". It is applied to satisfy the consumptive use in excess of that supplied from natural sources.

As a practical matter, however, the quantity of water applied is usually in excess of the consumptive use, and that portion of the water that is not consumed or otherwise irrecoverably lost remains part of the water supply.

That portion of the applied water that is consumptively used and that which is otherwise irrecoverably lost is known as the "net water use". Therefore, the difference between the applied water and the net water use is the amount of applied water that is subject to reuse as a part of the common supply. To evaluate the overall needs for water in an area, the net water use must be determined.

Methods of Estimating Water Use

Thus, in areas where none of the applied water becomes available for reuse, the net water use can be determined by measuring the total water applied. On the other hand, in areas where a portion of the applied water becomes available for reuse, economic and technological limitations



JUNE LAKE

Josef Muench

Many recreation areas, centered around lakes and streams, have been and are still being developed and utilized in the southern Lahontan area.

generally preclude measurement of the volume of return flow of reusable water. The net water use in these areas must be determined in another manner; therefore, an indirect method is used.

Using the indirect method most commonly employed, estimates of net water use are obtained by multiplying the areas of the various classes of water-using developments by appropriate average values of unit water use. These unit values of water use reflect average conditions of precipitation and the normal practices associated with urban water distribution and with irrigated agriculture. Variations from normal or average in these factors during the specific year that a land use survey is conducted may result in a difference between the estimated and actual water use during that year. Despite this possibility, the procedures used in this survey are considered adequate and the figures on current levels of water use are thought to be reasonable. Furthermore, these estimates of net water use are believed to be sufficiently sound to permit their use in determining adequacy of presently available water supplies and in planning for such additional supplies as will be necessary to meet current or expected future deficiencies.

Unit Values of Water Use

A complete discussion of the techniques employed in the derivation of unit values of water use is contained in California State Water Resources Board Bulletin No. 2 (listed earlier); consequently, only a very general discussion of those techniques is set forth here. The unit water use values are divided into the general categories of urban and suburban water use values and irrigated agriculture water use values.

Urban and Suburban Water Use Values

A review of the unit values of urban and suburban water use developed for Bulletin No. 2 indicated that, in general, the values derived in 1950 were still the best estimates available. These values were, therefore, used in the derivation of the 1961 levels of net water use on urban and suburban lands. The unit values of urban and suburban net water use are shown in Table 9.

TABLE 9

ESTIMATED MEAN SEASONAL UNIT VALUES OF NET WATER USE ON
URBAN AND SUBURBAN LANDS, SOUTHERN LAHONTAN AREA

In feet of depth

Hydrographic unit	:	Net water use
Mono Lake	(6-7)	0.8
Adobe Valley	(6-8)	0.8
Owens River	(6-9)	0.9
Death Valley	(6-10)	0.3
Mojave River	(6-11)	1.2
Antelope Valley	(6-12)	1.0

Mean seasonal unit values of water use on urban and suburban lands in the desert areas of California were estimated for Bulletin No. 2 from records of measured water deliveries obtained from private and public water service agencies. In areas where sewage disposed from urban and suburban areas returns to the ground water body, unit values of water use were computed by deducting the estimated quantity of such return from the amount of water delivered to the area. In other areas where sewage is discharged to the point of final disposal without opportunity for reuse, the gross delivery was taken as a measure of the net water use.

In the Death Valley, Mojave River, and Antelope Valley Hydrographic Units, the class of land use called "recreational residential"

in the tables of land use in Chapter III consists generally of small dwellings on 2.5 to 5-acre tracts. A study made to evaluate the water requirements of this land use class disclosed that these tracts, which were usually occupied less than 25 percent of the time, usually obtained water supplies from agencies that truck water to the dwellings at a relatively high cost, or the recreationists carried in water, either from their permanent dwellings or from nearby sources. Because these supplies were used for drinking, cooking, and essential washing purposes only, the total seasonal volume of water used was determined to be very small (on the order of 0.01 acre-foot per acre). Therefore, this minor use was neglected in the determination of water use in this report. The recreational residential land use class in the Mono Lake and Owens River Hydrographic Units consisted primarily of summer cabins in mountain resort areas. These resort areas have a high occupancy from June through September, and therefore, were included in the evaluation of water use.

Irrigated Agriculture Water Use Values

The unit values of consumptive use of applied water for each of the irrigated crop classes employed in Bulletin No. 2 was estimated by a modification of a method developed by Harry F. Blaney and Wayne D. Criddle of the United States Department of Agriculture. In the present investigation, as in Bulletin No. 2, the increased use of water resulting from multiple cropping practices in some localities was considered in estimating average unit values of water use for truck crops. The values thus derived are presented in Table 10.

ESTIMATED MEAN SEASONAL UNIT VALUES OF CONSUMPTIVE USE OF WATER
ON IRRIGATED LANDS, SOUTHERN LAHONTAN AREA

In feet of depth

Hydrographic units	Alfalfa	Pasture	Citrus and sub- tropical	Truck crops	Sugar beets	Miscel- laneous field crops	Deciduous fruits and nuts	Small grains	Rice	Vineyards
<u>Mono Lake</u>										
Applied water	--	1.4	--	--	--	--	--	--	--	--
Precipitation	--	<u>0.9</u>	--	--	--	--	--	--	--	--
TOTAL	--	2.3	--	--	--	--	--	--	--	--
<u>Adobe Valley</u>										
Applied water	--	1.5	--	--	--	--	--	--	--	--
Precipitation	--	<u>0.8</u>	--	--	--	--	--	--	--	--
TOTAL	--	2.3	--	--	--	--	--	--	--	--
<u>Owens River</u>										
Applied water	2.0	1.8	--	1.4	1.2	1.2	1.5	--	--	--
Precipitation	<u>0.6</u>	<u>0.6</u>	--	<u>0.6</u>	<u>0.6</u>	<u>0.6</u>	<u>0.6</u>	--	--	--
TOTAL	2.6	2.4	--	2.0	1.8	1.8	2.1	--	--	--
<u>Death Valley</u>										
Applied water	3.0	2.8	--	1.6	2.2	1.6	--	1.1	4.1	--
Precipitation	<u>0.4</u>	<u>0.4</u>	--	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	--	<u>0.4</u>	<u>0.4</u>	--
TOTAL	3.4	3.2	--	2.0	2.6	2.0	--	1.5	4.5	--
<u>Mojave River</u>										
Applied water	2.8	2.7	--	1.5	2.2	1.5	2.1	0.9	--	--
Precipitation	<u>0.4</u>	<u>0.4</u>	--	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	--	--
TOTAL	3.2	3.1	--	1.9	2.6	1.9	2.5	1.3	--	--
<u>Antelope Valley</u>										
Applied water	3.0	2.8	2.8	1.4	2.0	1.5	2.2	0.8	4.1	2.4
Precipitation	<u>0.6</u>	<u>0.6</u>	<u>0.6</u>	<u>0.6</u>	<u>0.6</u>	<u>0.6</u>	<u>0.6</u>	<u>0.6</u>	<u>0.6</u>	<u>0.6</u>
TOTAL	3.6	3.4	3.4	2.0	2.6	2.1	2.8	1.4	4.7	3.0

The values shown in Table 10 represent estimates of the average consumptive uses derived from applied water and from precipitation by the various types of irrigated agriculture. As pointed out before, in the derivation of the net water use for any given year, the volume of applied water required is based on the assumption that the precipitation for the season is approximately equal to the long-time mean. However, as discussed earlier, the use of applied water in irrigated agriculture will actually be somewhat larger or smaller in individual years, varying inversely with the amount of rainfall. A similar effect also occurs in urban use, but variations of rainfall from year to year have a lesser effect upon the use of applied water on urban lands than on irrigated lands. The precipitation data shown on Table 10 indicate that the beneficial value of precipitation is minor.

Estimates of 1961 Net Water Use

Estimates of the net water use in the southern Lahontan area under 1961 conditions of development were made by the indirect method discussed previously; that is, by applying mean seasonal unit values of consumptive use of applied water to the areas of each class of land use.

The estimated amounts of mean seasonal net water use in hydrographic units of the southern Lahontan area for 1961 conditions are presented in Table 11; values estimated for 1950 and 1957 conditions are also given in this table for comparison.

The unit values used to derive the net water use in Table 11 represent the optimum needs of the various types of water using developments for mean conditions of temperature and precipitation and, therefore, provide comparable estimates which show general level of water use. The

actual water use may have differed from the estimated values derived herein, because of irrigation practices and variations from the mean in precipitation and temperature, or because optimum needs were not being met.

Available data from precipitation stations in the desert area indicate that precipitation over the northern portion of the area of investigation during 1950 was about 71 percent of normal, based on the 50-year mean period 1897-98 through 1946-47. In the southern portion of the area, the precipitation was about 52 percent of normal in 1950 and about 33 percent of normal in 1957. During 1961, precipitation was about 46 percent of the 50-year normal figure.

The estimates of net water use shown in Table 11 are, therefore, probably on the low side for 1950, 1957, and 1961 as compared to actual water use in those years. However, the total amount of precipitation in desert areas is usually quite small even during wet years, thus the values given in Table 11 are considered to be reasonable estimates of changes in water use.

In general, the data presented in Table 11 indicate that changes in net water use reflect the changes in land use described in Chapter III. The overall net water use for the area decreased about 13 percent between 1950 and 1961, primarily as a result of decreases in irrigated agriculture. Urban requirements increased substantially, more than 6-1/2 times the water use in 1950, but at the present time, they constitute only about 18 percent of the total net water requirements of the area. On the other hand, water requirements for agriculture decreased in all areas except in the Mojave River and northern Death Valley Units.

TABLE 11

ESTIMATED LEVELS OF NET WATER USE IN THE SOUTHERN LAHONTIAN AREA
FOR CONDITIONS OF DEVELOPMENT IN 1950, 1957, AND 1961

In acre-feet

Hydrographic unit	:	1950	:	1957	:	1961	:	Differ- ence	:	Differ- ence
	:		:		:		:	1950-1961	:	1957-1961
<u>Mono Lake Unit</u>										
Irrigated lands		2,800		--		0	-	2,800		--
Urban-suburban areas		<u>100</u>		--		<u>100</u>		<u>0</u>		--
TOTALS		2,900		--		100	-	2,800		--
<u>Adobe Valley Unit</u>										
Irrigated lands		3,300		--		0	-	3,300		--
Urban-suburban areas		<u>0</u>		--		<u>0</u>		<u>0</u>		--
TOTALS		3,300		--		0	-	3,300		--
<u>Owens River Unit</u>										
Irrigated lands		18,200		--		7,300	-	10,900		--
Urban-suburban areas		<u>1,300</u>		--		<u>2,900</u>		<u>1,600</u>		--
TOTALS		19,500		--		10,200	-	9,300		--
<u>Northern Portion of Death Valley Unit</u>										
Irrigated lands		2,000		--		3,200		1,200		--
Urban-suburban areas		<u>200</u>		--		<u>300</u>		<u>100</u>		--
TOTALS		2,200		--		3,500		1,300		--
<u>Total Northern Portion of Study Area</u>										
Irrigated lands		26,300		--		10,500	-	15,800		--
Urban-suburban areas		<u>1,600</u>		--		<u>3,300</u>		<u>1,700</u>		--
TOTALS		27,900		--		13,800	-	14,100		--

ESTIMATED LEVELS OF NET WATER USE IN THE SOUTHERN LAHONTAN AREA
FOR CONDITIONS OF DEVELOPMENT IN 1950, 1957, AND 1961
(continued)

In acre-feet

Hydrographic unit	: 1950	: 1957	: 1961	: Differ- : ence	: Differ- : ence
	: 1950-1961	: 1957-1961			
<u>Southern Portion of Death Valley Unit</u>					
Irrigated lands	23,000	21,900	13,200	- 9,800	- 8,700
Urban-suburban areas	<u>300</u>	<u>700</u>	<u>2,300</u>	<u>2,000</u>	<u>1,600</u>
TOTALS	23,300	22,600	15,500	- 7,800	- 7,100
<u>Mojave River Unit</u>					
Irrigated lands	31,400	27,700	34,000	2,600	6,300
Urban-suburban areas	<u>2,600</u>	<u>4,900</u>	<u>19,600</u>	<u>17,000</u>	<u>14,700</u>
TOTALS	34,000	32,600	53,600	19,600	21,000
<u>Antelope Valley Unit</u>					
Irrigated lands	200,000	131,700	147,000	-53,000	15,300
Urban-suburban areas	<u>2,200</u>	<u>9,500</u>	<u>19,000</u>	<u>16,800</u>	<u>9,500</u>
TOTALS	202,200	141,200	166,000	-36,200	24,800
<u>Total Southern Portion of Study Area</u>					
Irrigated lands	254,400	181,300	194,200	-60,200	12,900
Urban-suburban areas	<u>5,100</u>	<u>15,100</u>	<u>40,900</u>	<u>35,800</u>	<u>25,800</u>
TOTALS	259,500	196,400	235,100	-24,400	38,700
<u>Total Study Area</u>					
Irrigated lands	280,700	--	204,700	-76,000	--
Urban-suburban areas	<u>6,700</u>	--	<u>44,200</u>	<u>37,500</u>	--
TOTALS	287,400	--	248,900	-38,500	--



CHAPTER V. SUMMARY OF FINDINGS AND CONCLUSIONS

The results of the 1961 land and water use survey of the southern Lahontan area of California, a comparison with the 1950 and 1957 survey results, and the conclusions drawn from this study are summarized in this chapter.

Summary of Findings

This investigation disclosed that in 1961 the following land uses and water requirements existed in the area of investigation:

1. Population in the study area increased from 71,000 in 1950 to 177,000 in 1960, an increase of 149 percent. Growth in the town of Lancaster exceeded that of other areas, increasing from 3,600 persons in 1950 to 26,000 in 1960.
2. A total of 187,500 acres, or about 1 percent of all lands within the survey area, have been developed for urban and suburban uses, or irrigated agriculture uses. This represents a decrease of about 30 percent since the 1950 survey for the northern portion of the area, (that above the Kern-San Bernardino-Inyo county line), and an increase of 64 percent since the 1957 survey in the southern portion.
3. The gross urban and suburban area was slightly more than 98,000 acres in 1961. In the northern part of the investigational area, the gross urban and suburban water service areas increased from about 800 acres in 1950 to 5,300 acres in 1961. In the southern portion of the study area the gross urban and suburban water service area increased from about 17,100 acres in 1957 to 92,800 acres in 1961. These values include vacant land undergoing subdivision.



MOJAVE RIVER VALLEY

Photography by Fairchild Aerial Surveys

Cultural development is mainly confined to valley areas where ground water supplies are available.

4. The gross irrigated agricultural area in the southern portion of the study area was about 83,000 acres in 1961, a decrease of approximately 8 percent over the 90,000 acres that existed in 1957. The northern portion contained about 6,300 acres of irrigated agriculture, approximately 9,300 acres, or nearly 60 percent less than the 1950 total.

5. About 248,900 acre-feet was the estimated net mean seasonal level of water used by water-using developments. Overall net water use decreased about 38,500 acre-feet or 13 percent between 1950 to 1961, mainly as a result of decreases in irrigated agriculture. The acreage of agricultural lands under irrigation in the Owens River and Mono Lake Units during any year is dependent on operations of the City of Los Angeles. Therefore, the acreage in irrigated agriculture in these units is subject to wide fluctuations from year to year, and the 13 percent decrease in net water use between 1950 and 1961 reported herein is not representative of actual conditions prevailing between the survey years because, as indicated earlier, 1961 was a dry year, with precipitation only about 46 percent of the 50-year normal. Urban requirements have gone up considerably, but they have only a minor effect upon the total picture because they constitute but 18 percent of the total net water requirements of the area.

Conclusions

Based on the results of this investigation, it is concluded that:

1. Where an adequate supply of water is available, cultural development has occurred and has been sustained in the southern Lahontan area.

2. Trends regarding land and water use along with population growth patterns are not firm enough to predict with precision the water supplies that will be needed in the future. Therefore, future land use surveys will be needed.

APPENDIX A

DEFINITION OF TERMS USED IN REPORT



APPENDIX A

DEFINITION OF TERMS USED IN REPORT

Annual - The 12-month period from January 1 of a given year through December 31 of the same year, sometimes termed the "calendar year".

Applied Water - Water delivered to a farmer's headgate, in the case of irrigation use, or to an individual's meter in the case of urban use, or the equivalent. Applied water does not include direct precipitation.

Average - An arithmetical average relating to a period other than a mean period.

Consumptive Use of Water - Water consumed by vegetative growth in transpiration and building plant tissue, and water evaporated from adjacent soil, from water surface, and from foliage. It also refers to water similarly consumed and evaporated by urban and nonvegetative types of land use.

Hydrographic Unit - A classification, established for purposes of hydrologic study, used in Bulletin No. 2 to designate an area whose boundaries were determined from consideration of water supply and related water service.

Hydrologic Unit* - In this bulletin, a classification embracing one of the following two topographic characteristics, both of which are defined by surface drainage divides:

*The areal designation system, i.e., categorizing areas into units, subunits, and subareas, is designed to separate data according to areas of hydrologic significance. The system, as developed, does not differentiate between ground water-bearing formations and nonground water-bearing tributary areas, although land use, as inventoried, does differentiate between such boundaries.

- a. In general, the total watershed area, including water-bearing and nonwater-bearing formations, such as the total drainage area of the Ventura River Valley.
- b. In coastal areas, two or more small contiguous watersheds having similar hydrologic characteristics and water supply problems, each watershed being directly tributary to the ocean and all watersheds emanating from one mountain body located immediately adjacent to the ocean.

Hydrologic Subunit* - In this bulletin, a major logical subdivision of a hydrologic unit, including water-bearing and nonwater-bearing formations, best typified by a major tributary of a stream, a major valley, or a plain along a stream containing one or more ground water basins and having closely related geologic, hydrologic, and topographic characteristics.

Hydrologic Subarea* - In this bulletin, a logical subdivision of a hydrologic subunit which may include either water-bearing or nonwater-bearing formations or both. Where possible, a hydrologic subarea includes one known ground water basin and its tributary area; the ground water basin comprising the water-bearing deposits of the subarea. In areas which are essentially nonwater-bearing, the subarea division was based only on surface drainage conditions, and such factors as locations of gaging stations were given due consideration.

*The areal designation system, i.e., categorizing areas into units, subunits, and subareas, is designed to separate data according to areas of hydrologic significance. The system, as developed, does not differentiate between ground water-bearing formations and nonground water-bearing tributary areas, although land use, as inventoried, does differentiate between such boundaries.

Mean - An arithmetical average relating to a mean period.

Mean Period - A period chosen to represent conditions of water supply and climate over a long series of years. For the current investigation, the mean precipitation period embraces the 50 seasons from 1897-98 through 1946-47.

Net Water Use - That portion of the water historically applied, or estimated to have been applied, which is consumptively utilized for beneficial purposes or otherwise irrecoverably lost. It does not include that portion of the applied water that is subject to possible reuse.

Present - Land use and water use and supply conditions prevailing during the 1960-61 season.

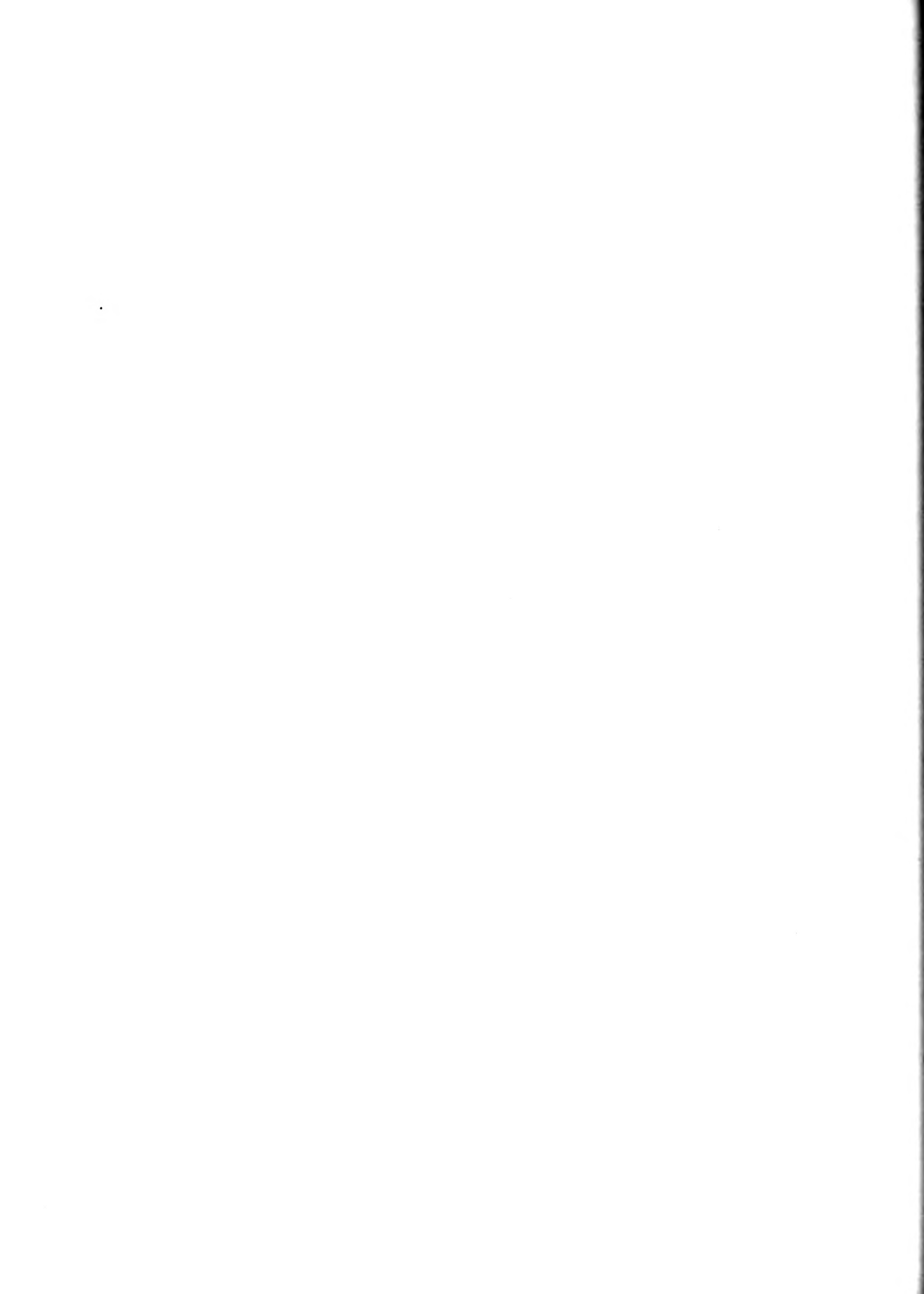
Seasonal - Any 12-month period other than the calendar year.

Water Requirement - The water needed to provide for all beneficial uses and for all irrecoverable losses incidental to such uses. Water requirement includes the portion supplied from direct precipitation.

Water Use - Water use includes all employments of water by nature or man, whether consumptive or nonconsumptive, as well as irrecoverable losses of water incidental to such employment, and is synonymous with the term "water utilization".

APPENDIX B

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS
OF THE SOUTHERN LAHONTAN AREA, IN 1961



LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS
OF THE SOUTHERN LAHONTIAN AREA IN 1961

In acres

Category and class of land use	Owens Hydrologic Unit						Total Unit
	Mono Hydrologic Unit	Adobe Hydrologic Unit	Long Subunit	Upper Owens Subunit	Lower Owens Subunit	Centennial Subunit	
<u>WATER SERVICE AREA</u>							
<u>Urban and Suburban</u>							
Residential	80	0	150	700	310	0	1,160
Recreational residential	120	0	270	40	30	0	340
Commercial	30	0	70	150	80	0	300
Industrial	0	0	0	20	20	0	40
Unsegregated urban and suburban area	20	a	20	580	310	0	910
Subtotals	250	0	510	1,490	750	0	2,750
Included Nonwater Service Area	70	a	110	810	490	0	1,410
Gross Urban and Suburban Area	320	0	620	2,300	1,240	0	4,160
<u>Irrigated Agriculture</u>							
Alfalfa	0	0	0	1,040	340	0	1,380
Pasture	0	0	0	2,180	310	0	2,490
Citrus and subtropical	0	0	0	0	0 a	0	0
Truck crops	0	0	0	0	0	0	0
Field crops	0	0	0	50	0	0	50
Deciduous fruits and nuts	0	0	0	30	0	0	30
Small grains	0	0	0	0	0	0	0
Vineyards	0	0	0	0	0	0	0
Subtotals	0	0	0	3,300	650	0	3,950
Fallow	0	0	0	20	0	0	20
Included Nonwater Service Area	0	0	0	520	390	0	910
Gross Irrigated Agriculture	0	0	0	3,840	1,040	0	4,880
GROSS WATER SERVICE AREA	320	0	620	6,140	2,280	0	9,040
<u>NONWATER SERVICE AREA</u>							
Nonirrigated Agriculture	0	0	2,680 b	12,240 b	1,610 b	0	16,530
Native Vegetation	189,970	38,650	86,980 c	265,230 d	346,170 e	31,470	729,850
Unclassified	237,890	158,780	158,340	659,110	451,350	43,800	1,312,600
GROSS NONWATER SERVICE AREA	427,860	197,430	248,000	936,580	799,130	75,270	2,058,980
TOTALS	428,180	197,430	248,620	942,720	801,410	75,270	2,068,020

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS
OF THE SOUTHERN LAHONTAN AREA IN 1961
(continued)

In acres

Category and class of land use	Fish Lake			Deep			Eureka Hydrologic Unit			Saline Hydrologic Unit			
	:Hydrologic: Unit	:Springs	:Hydrologic: Unit	:Marble Bath	:Eureka Subunit	:Total Unit	:Saline Subunit	:Cameo Subunit	:Total Unit				
WATER SERVICE AREA													
Urban and Suburban													
Residential	10	0		0	0	0	0	0	0	0			
Recreational residential	0	0		0	0	0	0	0	0	0			
Commercial	0	10		0	0	0	0	0	0	0			
Industrial	0	0		0	0	0	0	0	0	0			
Unsegregated urban and suburban area	10	10		0	0	0	0	0	0	0			
Subtotals	20	20		0	0	0	0	0	0	0			
Included Nonwater Service Area	^a	10		0	0	0	0	0	0	0			
Gross Urban and Suburban Area	20	30		0	0	0	0	0	0	0			
Irrigated Agriculture													
Alfalfa	550	90		0	0	0	0	0	0	0			
Pasture	310	0		0	0	0	0	0	0	0			
Citrus and subtropical	0	0		0	0	0	0	0	0	0			
Truck crops	0	0		0	0	0	0	0	0	0			
Field crops	0	0		0	0	0	0	0	0	0			
Deciduous fruits and nuts	0	0		0	0	0	0	0	0	0			
Small grains	0	0		0	0	0	0	0	0	0			
Vineyards	0	0		0	0	0	0	0	0	0			
Subtotals	860	90		0	0	0	0	0	0	0			
Fallow	0	0		0	0	0	0	0	0	0			
Included Nonwater Service Area	170	40		0	0	0	0	0	0	0			
Gross Irrigated Agriculture	1,030	130		0	0	0	0	0	0	0			
GROSS WATER SERVICE AREA	1,050	160		0	0	0	0	0	0	0			
NONWATER SERVICE AREA													
Nonirrigated Agriculture	0	0		0	0	0	0	0	0	0			
Native Vegetation	45,720	26,680		5,550	118,770	124,320	137,440	8,400	145,840				
Unclassified	134,920	100,310		9,840	238,220	248,060	311,980	17,350	329,330				
GROSS NONWATER SERVICE AREA	180,640	126,990		15,390	356,990	372,380	449,420	25,750	475,170				
TOTALS	181,690	127,150		15,390	356,990	372,380	449,420	25,750	475,170				

OF THE SOUTHERN LAHONTIAN AREA IN 1961
(continued)

In acres

Category and class of land use	Race Track Hydrologic Unit				Amargosa Hydrologic Unit			
	Race Track		Hidden		Death Valley		Subarea	
	Subunit	Valley	Subunit	Valley	Subunit	Valley	Subunit	Valley
WATER SERVICE AREA								
Urban and Suburban								
Residential	0	0	0	0	0	0	0	0
Recreational residential	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Unsegregated urban and suburban area	0	0	0	0	0	0	0	0
Subtotals	0	0	0	0	0	0	0	0
Included Nonwater Service Area	0	0	0	0	0	0	0	0
Gross Urban and Suburban Area	0	0	0	0	0	0	0	0
Irrigated Agriculture								
Alfalfa	0	0	0	0	0	0	0	0
Pasture	0	0	0	0	0	0	0	0
Citrus and subtropical	0	0	0	0	0	0	0	0
Tree crops	0	0	0	0	0	0	0	0
Field crops	0	0	0	0	0	0	0	0
Deciduous fruits and nuts	0	0	0	0	0	0	0	0
Small grains	0	0	0	0	0	0	0	0
Vineyards	0	0	0	0	0	0	0	0
Subtotals	0	0	0	0	0	0	0	0
Fallow	0	0	0	0	0	0	0	0
Included Nonwater Service Area	0	0	0	0	0	0	0	0
Gross Irrigated Agriculture	0	0	0	0	0	0	0	0
GROSS WATER SERVICE AREA	0	0	0	0	0	0	0	0
NONWATER SERVICE AREA								
Nonirrigated Agriculture	0	0	0	0	0	0	0	0
Native Vegetation	17,650	4,850	2,360	2,490	856,400	7,230	36,050	
Unclassified	23,200	13,960	2,900	10,940	1,089,660	14,760	47,150	
GROSS NONWATER SERVICE AREA	40,850	18,810	5,260	13,430	1,946,060	21,990	83,200	
TOTALS	40,850	18,810	5,260	13,430	1,946,250	21,990	83,200	

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS
OF THE SOUTHERN LAHONTIAN AREA IN 1961
(continued)

In acres

Category and class of land use	Amargosa Hydrologic Unit (continued)									
	Val Jean Subunit					Furnace Creek Subunit				
	Avawatz : Subarea :	Red Pass : Subarea :	Val Jean : Subarea :	Shadow : Subarea :	Furnace : Subarea :	Creek : Subarea :	Green- water :	Calico : Subarea :	Amargosa : Subarea :	Amargosa Subunit
WATER SERVICE AREA										
<u>Urban and Suburban</u>										
Residential	0	0	0	a	0	0	0	0	0	190
Recreational residential	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	0	a	10	0	0	0	0	50
Industrial	0	0	0	0	0	0	0	0	0	0
Unsegregated urban and suburban area	0	0	0	10	0	0	0	0	0	a
Subtotals	0	0	0	10	10	10	0	0	0	240
Included Nonwater Service Area	0	190	10	20	a	0	0	0	0	150
Gross Urban and Suburban Area	0	190	10	30	10	10	0	0	0	390
<u>Irrigated Agriculture</u>										
Alfalfa	0	0	0	0	0	0	0	0	0	20
Pasture	0	0	0	0	0	0	0	0	0	0
Citrus and subtropical	0	0	0	0	0	0	0	0	0	0
Tree crops	0	0	0	0	0	0	0	0	0	0
Field crops	0	0	0	0	0	0	0	0	0	0
Deciduous fruits and nuts	0	0	0	0	0	0	0	0	0	0
Small grains	0	0	0	0	0	0	0	0	0	0
Vineyards	0	0	0	0	0	0	0	0	0	0
Subtotals	0	0	0	0	0	0	0	0	0	20
Fallow	0	0	0	0	0	0	0	0	0	0
Included Nonwater Service Area	0	0	0	0	0	0	0	0	0	a
Gross Irrigated Agriculture	0	0	0	0	0	0	0	0	0	20
GROSS WATER SERVICE AREA	0	190	10	30	10	10	0	0	0	410
NONWATER SERVICE AREA										
<u>Nonirrigated Agriculture</u>										
Native Vegetation	5,180	115,630	247,240	155,000	21,140	24,170	0	0	0	302,610
Unclassified	5,780	49,730	159,380	109,280	74,890	24,360	0	39,820	38,430	181,770
GROSS NONWATER SERVICE AREA	10,960	165,360	406,620	264,280	96,030	48,530	0	78,250	76,860	484,380
TOTALS	10,960	165,550	406,630	264,310	96,040	48,530	0	78,250	76,860	484,790

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS
OF THE SOUTHERN LAHONTAN AREA IN 1961
(continued)

In acres

Category and class of land use	Amargosa Hydrologic Unit (cont):										Owlshead Hydrologic Unit			
	Amargosa Subunit:			Pahrump:			Mesquite:			Ivanpah:			Lost Lake:	
	: Chicago:			: Hydrologic:			: Hydrologic:			: Hydrologic:			: Subunit:	
	: Subarea:			: Unit:			: Unit:			: Unit:			: Subunit:	
WATER SERVICE AREA														
Urban and Suburban	0	10	240	0	0	0	0	0	0	50	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recreational residential	0	0	90	0	0	0	0	0	0	10	0	0	0	0
Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unsegregated urban and suburban area	0	0	50	0	0	0	0	0	0	0	0	0	0	0
Subtotals	0	10	380	0	0	0	0	0	0	60	0	0	0	0
Included Nonwater Service Area	0	10	410	0	0	a	0	0	0	50	0	0	0	0
Gross Urban and Suburban Area	0	20	790	0	0	0	0	0	0	110	0	0	0	0
Irrigated Agriculture														
Alfalfa	0	0	20	0	0	0	0	0	0	0	0	0	0	0
Pasture	0	0	10	0	0	0	0	0	0	0	0	0	0	0
Citrus and subtropical	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Truck crops	0	0	40	0	0	0	0	0	0	0	0	0	0	0
Field crops	0	0	0	0	0	0	190	0	0	0	0	0	0	0
Deciduous fruits and nuts	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Small grains	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vineyards	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotals	0	0	70	0	0	0	190	0	0	0	0	0	0	0
Fallow	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Included Nonwater Service Area	0	0	a	0	0	0	0	0	0	0	0	0	0	0
Gross Irrigated Agriculture	0	0	70	0	0	0	200	0	0	0	0	0	0	0
GROSS WATER SERVICE AREA	0	20	860	0	0	0	210	0	0	110	0	0	0	0
NONWATER SERVICE AREA														
Nonirrigated Agriculture	0	0	0	0	0	0	1,010	0	0	0	0	0	0	0
Native Vegetation	44,960	51,310	1,906,740	93,610	86,150	84,580	193,550	4,860	21,600	26,460	0	0	26,460	0
Unclassified	29,950	31,990	1,857,130	31,820	53,580	84,500	84,500	36,520	38,640	75,160	0	0	75,160	0
GROSS NONWATER SERVICE AREA	74,910	83,300	3,763,870	125,430	140,740	278,050	278,050	41,380	60,240	101,620	0	0	101,620	0
TOTALS	74,910	83,320	3,764,730	125,430	140,950	278,160	278,160	41,380	60,240	101,620	0	0	101,620	0

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS
OF THE SOUTHERN LAHONTAN AREA IN 1961
(continued)

In acres

Category and class of land use	Nelson Hydrologic Unit									
	Leach		McLean		Nelson		Total		Bicycle	
	Hydrologic: Unit	Subunit	Hydrologic: Unit	Subunit	Hydrologic: Unit	Subunit	Hydrologic: Unit	Subunit	Hydrologic: Unit	Subunit
<u>WATER SERVICE AREA</u>										
<u>Urban and Suburban</u>										
Residential	0	0	0	0	0	0	0	0	0	0 ^a
Recreational residential	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0
Unsegregated urban and suburban area	0	0	0	0	0	0	0	0	10	10
Subtotals	0	0	0	0	0	0	0	0	10	10
Included Nonwater Service Area	0	0	0	0	0	0	0	10 ^a	10	10
Gross Urban and Suburban Area	0	0	0	0	0	0	0	10	10	10
<u>Irrigated Agriculture</u>										
Alfalfa	0	0	0	0	0	0	0	0	420	0
Pasture	0	0	0	0	0	0	0	0	0	0
Citrus and subtropical	0	0	0	0	0	0	0	0	0	0
Truck crops	0	0	0	0	0	0	0	0	0	0
Field crops	0	0	0	0	0	0	0	0	40	0
Deciduous fruits and nuts	0	0	0	0	0	0	0	0	0	0
Small grains	0	0	0	0	0	0	0	0	0	0
Vineyards	0	0	0	0	0	0	0	0	0	0
Subtotals	0	0	0	0	0	0	0	0	460	0
Fallow	0	0	0	0	0	0	0	0	0	0
Included Nonwater Service Area	0	0	0	0	0	0	0	0	30	0
Gross Irrigated Agriculture	0	0	0	0	0	0	0	0	490	0
GROSS WATER SERVICE AREA	0	0	0	0	0	0	0	10	500	10
<u>NONWATER SERVICE AREA</u>										
Nonirrigated Agriculture	0	0	0	0	0	0	0	0	80	0
Native Vegetation	49,960	13,450	23,930	37,380	57,450	19,320	92,970	67,550	92,970	67,550
Unclassified	49,180	9,130	8,030	17,160	29,590	23,990	73,220	117,030	73,220	117,030
GROSS NONWATER SERVICE AREA	99,140	22,580	31,960	54,540	87,040	43,310	166,270	184,580	166,270	184,580
TOTALS	99,140	22,580	31,960	54,540	87,050	43,310	166,770	184,590	166,770	184,590

OF THE SOUTHERN LAHONTAN AREA IN 1961
(continued)

In acres

Category and class of land use	Panamint Hydrologic Unit									
	Wingate	White	Wild Rose Subunit	Lee Flat	Santa Rosa Flat Subunit	Santa Rosa Flat Subunit	Silver	Darwin	Dollar	Subarea
	Pass	Sage	Rose	Subunit	Rosa Flat	Rainbow	Subarea	Subarea	Subarea	Subarea
	Subunit	Subarea	Subarea	Subarea	Subarea	Subarea	Subarea	Subarea	Subarea	Subarea
WATER SERVICE AREA										
Urban and Suburban										
Residential	0	0	0	0	0	0	0	0	0	0
Recreational residential	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0
Unsegregated urban and suburban area	0	0	0	0	0	0	0	0	0	30
Subtotals	0	0	0	0	0	0	0	0	0	30
Included Nonwater Service Area	0	0	0	0	0	0	0	0	0	40
Gross Urban and Suburban Area	0	0	0	0	0	0	0	0	0	70
Irrigated Agriculture										
Alfalfa	0	0	0	0	0	0	0	0	0	0
Pasture	0	0	0	0	0	0	0	0	0	0
Citrus and subtropical	0	0	0	0	0	0	0	0	0	0
Truck crops	0	0	0	0	0	0	0	0	0	0
Field crops	0	0	0	0	0	0	0	0	0	0
Deciduous fruits and nuts	0	0	0	0	0	0	0	0	0	0
Small grains	0	0	0	0	0	0	0	0	0	0
Vineyards	0	0	0	0	0	0	0	0	0	0
Subtotals	0	0	0	0	0	0	0	0	0	0
Fallow	0	0	0	0	0	0	0	0	0	0
Included Nonwater Service Area	0	0	0	0	0	0	0	0	0	0
Gross Irrigated Agriculture	0	0	0	0	0	0	0	0	0	0
GROSS WATER SERVICE AREA	0	0	0	0	0	0	0	0	0	70
NONWATER SERVICE AREA										
Nonirrigated Agriculture	0	0	0	0	0	0	0	0	0	0
Native Vegetation	2,930	3,470	2,770	12,070	10,120	3,540	1,870	43,280	1,870	43,280
Unclassified	8,540	14,830	5,920	14,450	18,300	13,960	2,830	87,980	2,830	87,980
GROSS NONWATER SERVICE AREA	11,470	18,300	8,720	26,520	28,420	17,500	4,700	131,260	4,700	131,260
TOTALS	11,470	18,300	8,720	26,520	28,420	17,500	4,700	131,330	4,700	131,330

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS
OF THE SOUTHERN LAHONTAN AREA IN 1961
(continued)

In acres

Category and class of land use	Panamint Hydrologic Unit (continued)				Searles Hydrologic Unit			
	Panamint : Subunit :	Brown : Subunit :	Robbers : Subunit :	Total : Unit :	Searles : Subunit :	Salt : Wells :	Pilot : Knob :	Total : Unit :
WATER SERVICE AREA								
Urban and Suburban								
Residential	a	0	0	a	410	10	0	420
Recreational residential	0	0	0	0	0	0	0	0
Commercial	a	0	0	a	50	0	0	50
Industrial	0	0	0	0	70	0	0	70
Unsegregated urban and suburban area	a	0	0	30	10	0	0	10
Subtotals	0	0	0	30	540	10	0	550
Included Nonwater Service Area	a	0	40	80	830	120	150	1,100
Gross Urban and Suburban Area	0	0	40	110	1,370	130	150	1,650
Irrigated Agriculture								
Alfalfa	0	0	0	0	0	0	0	0
Pasture	0	0	0	0	0	0	0	0
Citrus and subtropical	0	0	0	0	0	0	0	0
Truck crops	0	0	0	0	0	0	0	0
Field crops	0	0	0	0	0	0	0	0
Deciduous fruits and nuts	0	0	0	0	0	0	0	0
Small grains	0	0	0	0	0	0	0	0
Vineyards	0	0	0	0	0	0	0	0
Subtotals	0	0	0	0	0	0	0	0
Fallow	0	0	0	0	0	0	0	0
Included Nonwater Service Area	0	0	0	0	0	0	0	0
Gross Irrigated Agriculture	0	0	0	0	0	0	0	0
GROSS WATER SERVICE AREA	0	0	40	110	1,370	130	150	1,650
NONWATER SERVICE AREA								
Nonirrigated Agriculture	0	0	0	0	0	0	0	0
Native Vegetation	233,130	18,660	94,500	426,340	156,120	29,280	51,710	237,110
Unclassified	327,030	24,890	97,910	616,670	168,060	25,350	30,120	223,530
GROSS NONWATER SERVICE AREA	560,160	43,550	192,410	1,043,010	324,180	54,630	81,830	460,640
TOTALS	560,160	43,550	192,450	1,043,120	325,550	54,760	81,980	462,290

OF THE SOUTHERN LAHONTAN AREA IN 1961
(continued)

In acres

Category and class of land use	Coso Hydrologic Unit				Indian Wells Hydrologic Unit			
	Wild	Coso	Total	Upper	Rose	Indian	Total	
	Subunit	Subunit	Unit	Unit	Subunit	Wells	Unit	
	Subunit				Subunit	Subunit		
WATER SERVICE AREA								
Urban and Suburban	0	0	0	0	10	1,070	1,080	
Residential	0	0	0	0	0	40	40	
Recreational residential	0	0	0	0	10	180	190	
Commercial	0	0	0	0	0	10	10	
Industrial	0	0	0	0	0	470	490	
Unsegregated urban and suburban area	0	0	0	0	0			
Subtotals	0	0	0	0	40	1,770	1,810	
Included Nonwater Service Area	0	0	0	0	50	2,400	2,450	
Gross Urban and Suburban Area	0	0	0	0	90	4,170	4,260	
Irrigated Agriculture								
Alfalfa	0	0	0	0	0	130	130	
Pasture	0	0	0	0	0	260	260	
Citrus and subtropical	0	0	0	0	0	0	0	
Truck crops	0	0	0	0	0	0	0	
Field crops	0	0	0	0	0	0	0	
Deciduous fruits and nuts	0	0	0	0	0	0	0	
Small grains	0	0	0	0	0	0	0	
Vineyards	0	0	0	0	0	0	0	
Subtotals	0	0	0	0	0	390	390	
Fallow	0	0	0	0	0	0	0	
Included Nonwater Service Area	0	0	0	0	0	20	20	
Gross Irrigated Agriculture	0	0	0	0	0	410	410	
GROSS WATER SERVICE AREA	0	0	0	0	90	4,580	4,670	
NONWATER SERVICE AREA								
Nonirrigated Agriculture	0	0	0	0	0	560	560	
Native Vegetation	2,660	33,670	36,330	4,480	40,360	271,790	312,150	
Unclassified	10,080	112,620	122,700	6,190	68,090	277,820	345,910	
GROSS NONWATER SERVICE AREA	12,740	146,290	159,030	10,670	108,450	550,170	658,620	
TOTALS	12,740	146,290	159,030	10,670	108,540	554,750	663,290	

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS
OF THE SOUTHERN LAHONTAN AREA IN 1961
(continued)

In acres

Category and class of land use	Fremont Hydrologic Unit					Antelope Hydrologic Unit				
	Dove	Kelso-	East	Koehn	Total	Chafee	Gloster	Willow		
	Springs : Subunit :	Landis : Subunit :	Tehachapi : Subunit :	Subunit :	Unit :	Subarea :	Subarea :	Springs : Subarea :		
<u>WATER SERVICE AREA</u>										
<u>Urban and Suburban</u>										
Residential	0	10	10	300	320	270	10	0		
Recreational Residential	0	0	0	0	0	0	30	0		
Commercial	0	0	0	30	30	80	0	0		
Industrial	0	0	10	0	10	50	0	20		
Unsegregated urban and suburban	0	0	50	180	230	40	80	200		
Subtotals	0	10	70	510	590	440	120	220		
Included Nonwater Service Area	0	^a	220	4,560	4,780	1,270	30	190		
Gross Urban and Suburban Area	0	10	290	5,070	5,370	1,710	150	410		
<u>Irrigated Agriculture</u>										
Alfalfa	0	0	280	2,850	3,130	850	90	1,330		
Pasture	0	0	0	190	190	0	10	0		
Citrus and subtropical	0	0	0	0	0	0	0	0		
Truck crops	0	0	180	0	180	0	10	270		
Field crops	0	0	40	20	60	0	0	0		
Deciduous fruits and nuts	0	0	0	0	0	0	10	0		
Small grains	0	0	0	180	180	0	0	0		
Vineyards	0	0	0	0	0	0	0	0		
Subtotals	0	0	500	3,240	3,740	850	120	1,600		
Fallow	0	0	80	0	80	0	0	0		
Included Nonwater Service Area	0	0	180	220	400	50	10	80		
Gross Irrigated Agriculture	0	0	760	3,460	4,220	900	130	1,680		
GROSS WATER SERVICE AREA	0	10	1,050	8,530	9,590	2,610	280	2,090		
<u>NONWATER SERVICE AREA</u>										
Nonirrigated Agriculture	0	80	3,260	7,100	10,440	0	50	800		
Native Vegetation	10,880	11,300	6,540	202,540	231,260	56,000	21,360	67,130		
Unclassified	15,680	12,680	46,850	255,840	331,050	7,120	18,790	42,290		
GROSS NONWATER SERVICE AREA	26,560	24,060	56,650	465,480	572,750	63,120	40,200	110,220		
TOTALS	26,560	24,070	57,700	474,010	582,340	65,730	40,480	112,310		

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS
OF THE SOUTHERN LAHONTIAN AREA IN 1961
(continued)

In acres

Category and class of land use	Antelope Hydrologic Unit (continued)							Cuddeback	
	Antelope Subunit (continued)							Total	
	Neenach : Subarea :	Lancaster : Subarea :	North : Muroc : Subarea :	Buttes : Subarea :	Rock : Creek : Subarea :	Rock : Creek : Subarea :	Unit	Unit	Unit
WATER SERVICE AREA									
<u>Urban and Suburban</u>									
Residential	10	4,420	1,390	250	570	570	6,920	10	
Recreational residential	10	10	0	0	220	220	270	0	
Commercial	0	530	230	10	60	60	910	10	
Industrial	0	60	10	0	0	0	140	0	
Unsegregated urban and suburban area	280	3,280	180	380	830	830	5,270	10	
Subtotals	300	8,300	1,810	640	1,680	1,680	13,510	30	
Included Nonwater Service Area	60	8,240	2,240	1,420	960	960	14,410	840	
Gross Urban and Suburban Area	360	16,540	4,050	2,060	2,640	2,640	27,920	870	
<u>Irrigated Agriculture</u>									
Alfalfa	2,060	33,180	1,300	660	1,550	1,550	41,020	0	
Pasture	120	2,030	10	40	260	260	2,470	0	
Citrus and subtropical	0	0	0	0	10	10	10	0	
Truck crops	950	640	130	0	50	50	2,050	0	
Field crops	470	1,640	80	40	30	30	2,260	0	
Deciduous fruits and nuts	10	480	10	20	870	870	1,400	0	
Small grains	2,060	2,720	0	100	10	10	4,890	0	
Vineyards	0	60	0	0	0	0	60	0	
Subtotals	5,670	40,750	1,530	860	2,780	2,780	54,160	0	
Fallow	1,480	840	0	30	a	a	2,350	0	
Included Nonwater Service Area	920	3,120	180	440	1,970	1,970	6,770	0	
Gross Irrigated Agriculture	8,070	44,710	1,710	1,330	4,750	4,750	63,280	0	
GROSS WATER SERVICE AREA	8,430	61,250	5,760	3,390	7,390	7,390	91,200	870	
<u>NONWATER SERVICE AREA</u>									
Nonirrigated Agriculture	47,290	62,620	1,230	2,040	1,760	1,760	115,790	0	
Native Vegetation	65,480	191,960	154,570	50,060	133,670	133,670	740,230	83,800	
Unclassified	55,730	238,570	129,620	34,880	100,870	100,870	627,870	48,840	
GROSS NONWATER SERVICE AREA	168,500	493,150	285,420	86,980	236,300	236,300	1,483,890	132,640	
TOTALS	176,930	554,400	291,180	90,370	243,690	243,690	1,575,090	133,510	

(continued)

In acres

NONWATER SERVICE AREA
Nonirrigated Agriculture
Native Vegetation
Unclassified

In acres

Category and class of land use	Mojave Hydrologic Unit (continued)										Broadwell : Hydrologic : Unit :	Total : Investi- : gation :
	Afton Subunit					Baker Subunit						
	Caves : Subarea :	Cronese : Subarea :	Langford : Subarea :	Silver : Lake :	Soda : Lake :	Subarea : Subarea :	Lake : Subarea :	Subarea : Subarea :	Kelso : Subunit :	Total : Unit :		
WATER SERVICE AREA												
Urban and Suburban												
Residential	0	0	130	0	0	30	0	0	10	8,350	10	18,650
Recreational residential	0	0 ^a	0	0	0	0	0	0	0	3,510	0	4,280
Commercial	10	0	20	0	30	0	0	0	0 ^a	950	10	2,590
Industrial	0	0	20	0	0	0	0	0	0	170	0	440
Unsegregated urban and suburban area	30	0	60	0	0	0	0	0	0	3,620	40	10,730
Subtotals	40	0	230	0	60	60	0	0	10	16,600	60	36,690
Included Nonwater Service Area	30	10	300	10	50	30	35,790	10	30	52,390	70	61,420
Gross Urban and Suburban Area	70	10	530	10	110	40	52,390	70	40	98,110	70	98,110
Irrigated Agriculture												
Alfalfa	620	0	0	0	0	0	9,670	0	0	56,410	0	56,410
Pasture	0	0	0	0	0	0	2,390	0	0	8,120	0	8,120
Citrus and subtropical	0	0	0	0	0	0	0	0	0	10	0	10
Truck crops	0	0	0	0	10	0	220	0	0	2,490	0	2,490
Field crops	0	0	0	0	0	0	790	0	0	3,390	0	3,390
Deciduous fruits and nuts	0	0	0	0	0	0	220	0	0	1,650	0	1,650
Small grains	0	0	0	0	0	0	50	0	0	5,120	0	5,120
Vineyards	0	0	0	0	0	0	0	0	0	60	0	60
Subtotals	620	0	0	0	10	0	13,340	0	0	77,250	0	77,250
Fallow	0	0	0	0	0	0	300	0	0	2,750	0	2,750
Included Nonwater Service Area	30	0	0	0	0	0	1,040	0	0	9,390	0	9,390
Gross Irrigated Agriculture	650	0	0	0	10	0	14,680	0	0	89,390	0	89,390
GROSS WATER SERVICE AREA	720	10	530	10	120	40	67,070	70	40	187,500	70	187,500
NONWATER SERVICE AREA												
Nonirrigated Agriculture	80	0	0	0	0	0	7,640	0	0	152,050	0	152,050
Native Vegetation	77,590	100,810	25,370	35,210	343,640	238,000	2,005,690	82,010	0	8,118,920	0	8,118,920
Unclassified	49,900	63,510	19,490	22,380	275,170	169,420	1,232,380	69,140	0	8,609,530	0	8,609,530
GROSS NONWATER SERVICE AREA	127,570	164,320	44,860	57,590	618,810	407,420	3,245,710	151,150	0	16,880,500	0	16,880,500
TOTALS	128,290	164,330	45,390	57,600	618,930	407,460	3,312,780	151,220	0	17,068,000	0	17,068,000

a. Less than five acres.

b. Acreage consists of pasture and idle lands which may be irrigated during years of adequate surface water supplies.

c, d, e. Acreage includes approximately 10,100 acres, 2,700 acres, and 1,400 acres, respectively, of native meadow land.



APPENDIX C

LIST OF DISTRICTS, AREAS, AND UNITS
FOR WHICH INDIVIDUAL TABULATIONS
OF 1961 LAND USES ARE AVAILABLE



APPENDIX C

LIST OF DISTRICTS, AREAS, AND UNITS FOR WHICH INDIVIDUAL TABULATIONS OF 1961 LAND USES ARE AVAILABLE

Utilizing machine techniques that were developed for processing data from this survey, individual tabulations of 1961 land use can be obtained for most of the political and hydrologic subdivisions within the area of investigation. However, reasonable limitations do not permit all these individual tabulations to be published in this report.

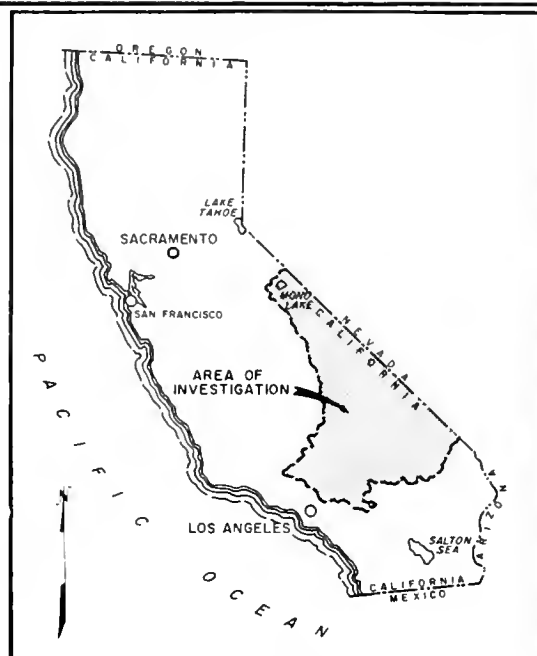
For those persons requiring more detailed information, this appendix lists all districts, areas, and units for which 1961 land use can be individually determined and tabulated by machine methods using data available in Department of Water Resources files. It should be noted that data were based on 1961 conditions, including boundaries, and have not been modified to reflect subsequent changes.

Census Tracts	Incorporated Cities
Census Divisions	National Forests
Community Services Districts	Public Utility Districts
County Water Districts	Sanitary Districts
County Water Works Districts	Sanitation Districts
Flood Control Districts	State Parks
	U. S. Geological Survey Quadrangles

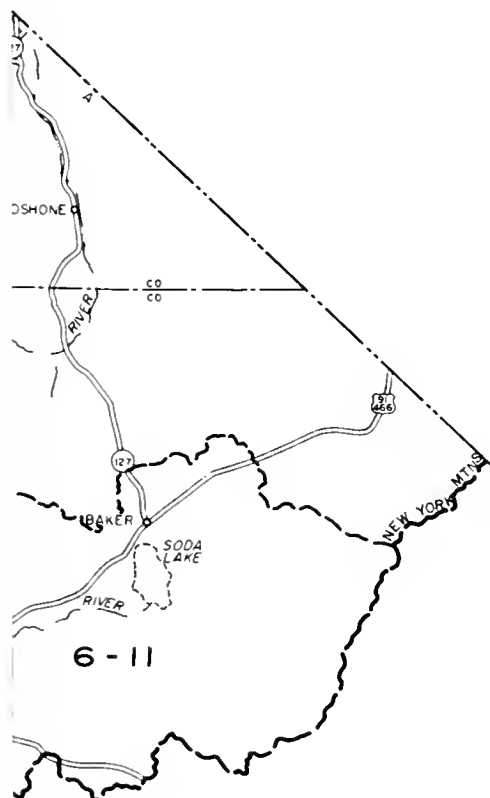
HYDROGRAPHIC AREA AND UNITS

OF LAHONTAN HYDROGRAPHIC AREA

- 7 MONO LAKE UNIT
- 8 ADOBE VALLEY UNIT
- 9 OWENS RIVER UNIT
- 10 DEATH VALLEY UNIT
- 11 MOJAVE RIVER UNIT
- 12 ANTELOPE VALLEY UNIT



LOCATION MAP



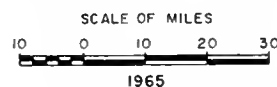
LEGEND

- BOUNDARY OF INVESTIGATIONAL AREA
- BOUNDARY OF HYDROGRAPHIC UNIT
- 6-8 HYDROGRAPHIC AREA AND UNIT NUMBER

STATE OF CALIFORNIA
 THE RESOURCES AGENCY
 DEPARTMENT OF WATER RESOURCES
 SOUTHERN DISTRICT

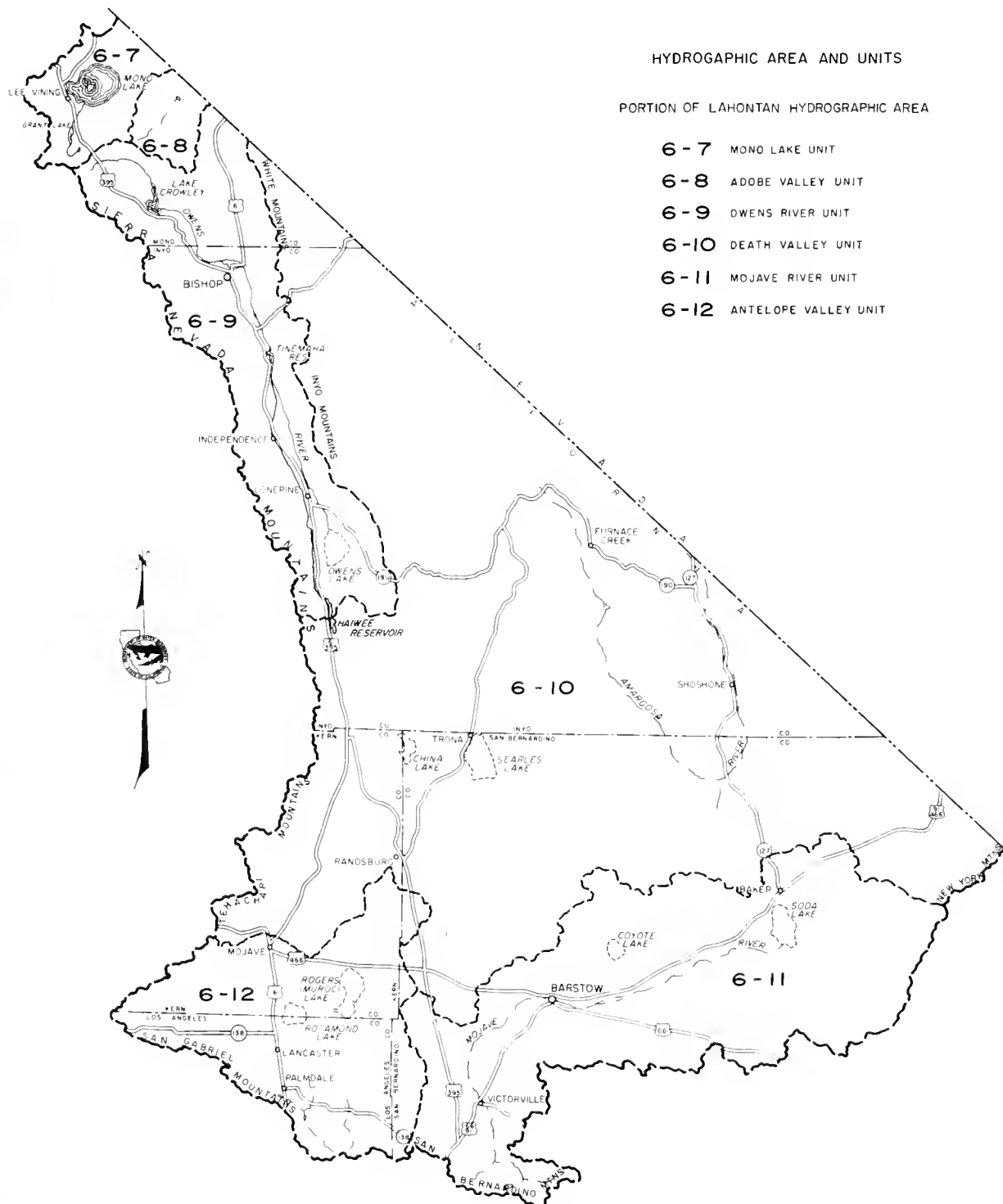
SOUTHERN LAHONTAN AREA
 LAND AND WATER USE SURVEY, 1961

AREA OF INVESTIGATION
 AND
 HYDROGRAPHIC UNITS



PORTION OF LAHONTAN HYDROGRAPHIC AREA

- 6-7 MONO LAKE UNIT
6-8 ADOBE VALLEY UNIT
6-9 DWENS RIVER UNIT
6-10 DEATH VALLEY UNIT
6-11 MOJAVE RIVER UNIT
6-12 ANTELOPE VALLEY UNIT



LOCATION MAP

LEGEND

- — — BOUNDARY OF INVESTIGATIONAL AREA
— — — BOUNDARY OF HYDROGRAPHIC UNIT
6-8 HYDROGRAPHIC AREA AND UNIT NUMBER

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

SOUTHERN LAHONTAN AREA
LAND AND WATER USE SURVEY, 1961

AREA OF INVESTIGATION
AND
HYDROGRAPHIC UNITS

SCALE OF MILES

10 0 10 20 30

1965



- W-01.00 MONO HYDRO UNIT
- W-02.00 ADOBE HYDRO UNIT
- W-03.00 OWENS HYDRO UNIT
W-03.A0 LONG HYDRO SUBUNIT
W-03.B0 UPPER OWENS HYDRO SUBUNIT
W-03.C0 LOWER OWENS HYDRO SUBUNIT
W-03.D0 CENTENNIAL HYDRO SUBUNIT
- W-04.00 FISH LAKE HYDRO UNIT
- W-05.00 DEEP SPRINGS HYDRO UNIT
- W-06.00 EUREKA HYDRO UNIT
W-06.A0 MARBLE BATH HYDRO SUBUNIT
W-06.B0 EUREKA HYDRO SUBUNIT
- W-07.00 SALINE HYDRO UNIT
W-07.A0 SALINE HYDRO SUBUNIT
W-07.B0 CAMEO HYDRO SUBUNIT
- W-08.00 RACE TRACK HYDRO UNIT
W-08.A0 RACE TRACK HYDRO SUBUNIT
W-08.B0 HIDDEN VALLEY HYDRO SUBUNIT
W-08.C0 ULIDA HYDRO SUBUNIT
W-08.D0 SAND FLAT HYDRO SUBUNIT
- W-09.00 AMARGOSA HYDRO UNIT
W-09.A0 DEATH VALLEY HYDRO SUBUNIT
W-09.A1 DEATH VALLEY HYDRO SUBUNIT
W-09.A2 HARRISBURGH HYDRO SUBUNIT
W-09.A3 WINGATE WASH HYDRO SUBUNIT
W-09.B0 VALJEAN HYDRO SUBUNIT
W-09.B1 AVAWATZ HYDRO SUBUNIT
W-09.B2 PED PASS HYDRO SUBUNIT
W-09.B3 VALJEAN HYDRO SUBUNIT
W-09.B4 SHADOW HYDRO SUBUNIT
W-09.C0 FURNACE CREEK HYDRO SUBUNIT
W-09.C1 FURNACE CREEK HYDRO SUBUNIT
W-09.C2 GREENWATER HYDRO SUBUNIT
W-09.D0 AMARGOSA HYDRO SUBUNIT
W-09.D1 CALICO HYDRO SUBUNIT
W-09.D2 AMARGOSA HYDRO SUBUNIT
W-09.D3 CHICAGO HYDRO SUBUNIT
W-09.D4 CALIFORNIA HYDRO SUBUNIT
- W-10.00 PAHRUMP HYDRO UNIT
- W-11.00 MESQUITE HYDRO UNIT
- W-12.00 IVANPAH HYDRO UNIT
- W-13.00 OWLSHEAD HYDRO UNIT
W-13.A0 LOST LAKE HYDRO SUBUNIT
W-13.B0 OWLSHEAD HYDRO SUBUNIT
- W-14.00 LEACH HYDRO UNIT
- W-15.00 NELSON HYDRO UNIT
W-15.A0 MCLEAN HYDRO SUBUNIT
W-15.B0 NELSON HYDRO SUBUNIT
- W-16.00 BICYCLE HYDRO UNIT
- W-17.00 GOLDSTONE HYDRO UNIT
- W-18.00 COYOTE HYDRO UNIT
- W-19.00 SUPERIOR HYDRO UNIT

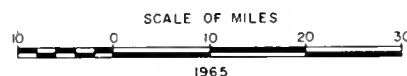
HYDROLOGIC



STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

SOUTHERN LAHONTAN AREA
LAND AND WATER USE SURVEY, 1961

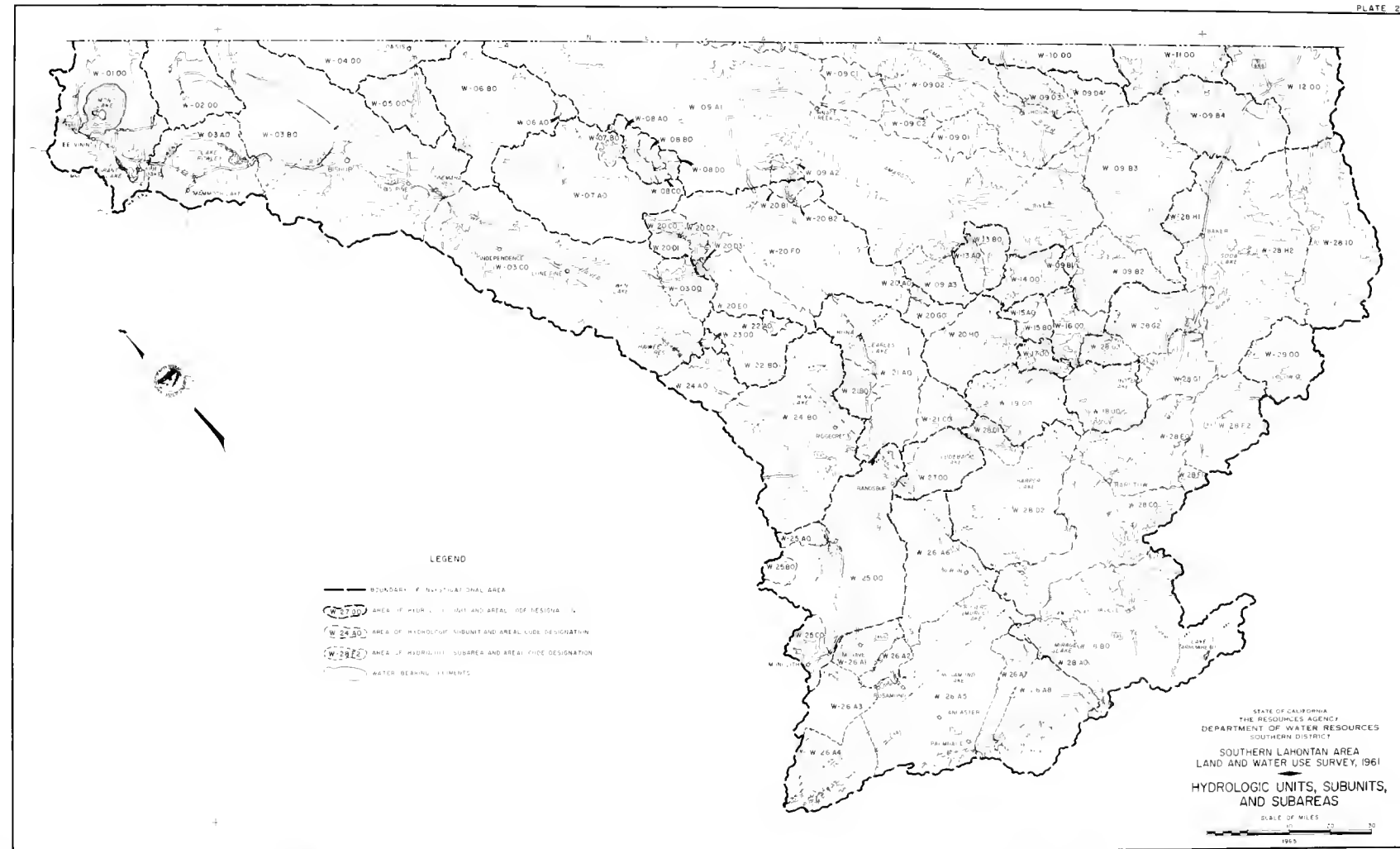
HYDROLOGIC UNITS, SUBUNITS,
AND SUBAREAS



AREAL DESIGNATIONS
HYDROLOGIC UNITS, SUBUNITS AND SUBAREAS

LAHONTAN DRAINAGE PROVINCE

- | | | | |
|---------|-----------------------------|---------|-------------------------------|
| W-01.00 | HYDRO HYDRO UNIT | W-20.00 | PANAMINT HYDRO UNIT |
| W-02.00 | SHOBE HYDRO UNIT | W-20.01 | WINDGATE PASS HYDRO SUBUNIT |
| W-03.00 | OWENS HYDRO UNIT | W-20.02 | WILCO ROSE HYDRO SUBAREA |
| W-03.01 | LONG HYDRO SUBUNIT | W-20.03 | WHITE SAIE HYDRO SUBAREA |
| W-03.02 | UPPER OWENS HYDRO SUBUNIT | W-20.04 | WILCO ROSE HYDRO SUBAREA |
| W-03.03 | LOWER OWENS HYDRO SUBUNIT | W-20.05 | LEE FLAT HYDRO SUBUNIT |
| W-03.04 | CENTENNIAL HYDRO SUBUNIT | W-20.06 | KANTA ROSA FLAT HYDRO SUBUNIT |
| W-04.00 | FEIN LAKE HYDRO UNIT | W-20.07 | SANTA ROSA FLAT HYDRO SUBAREA |
| W-05.00 | DEEP SPRINGS HYDRO UNIT | W-20.08 | RAINBOW HYDRO SUBAREA |
| W-06.00 | EUREKA HYDRO UNIT | W-20.09 | KILLER DOLLAR HYDRO SUBAREA |
| W-06.01 | MARBLE BATH HYDRO SUBUNIT | W-20.10 | DARWIN HYDRO SUBUNIT |
| W-06.02 | EUREKA HYDRO SUBUNIT | W-20.11 | PANAMINT HYDRO SUBUNIT |
| W-07.00 | CALINE HYDRO UNIT | W-20.12 | ROCKWELL HYDRO SUBUNIT |
| W-07.01 | CALINE HYDRO SUBUNIT | W-21.00 | SEARLES HYDRO UNIT |
| W-07.02 | CALINE HYDRO SUBUNIT | W-21.01 | SEARLES HYDRO SUBUNIT |
| W-08.00 | RACE TRACK HYDRO UNIT | W-21.02 | SALT WELLS HYDRO SUBUNIT |
| W-08.01 | RACE TRACK HYDRO SUBUNIT | W-21.03 | PILOT MOUNT HYDRO SUBUNIT |
| W-08.02 | HIDDEN VALLEY HYDRO SUBUNIT | W-22.00 | COSO HYDRO UNIT |
| W-08.03 | ALTO HYDRO SUBUNIT | W-22.01 | WILD HORSE HYDRO SUBUNIT |
| W-08.04 | SAND FLAT HYDRO SUBUNIT | W-22.02 | COSO HYDRO SUBUNIT |
| W-09.00 | AMARGOSA HYDRO UNIT | W-23.00 | UPPER PARTUS HYDRO UNIT |
| W-09.01 | DEATH VALLEY HYDRO SUBUNIT | W-23.01 | INDIAN WELLS HYDRO UNIT |
| W-09.02 | HARDISBURGH HYDRO SUBAREA | W-23.02 | RISE HYDRO SUBUNIT |
| W-09.03 | WINDGATE PASS HYDRO SUBAREA | W-23.03 | INDIAN WELLS HYDRO SUBUNIT |
| W-09.04 | VALLEJO HYDRO SUBUNIT | W-24.00 | FREMONT HYDRO UNIT |
| W-09.05 | AVARATZ HYDRO SUBAREA | W-24.01 | DOVE SPRINGS HYDRO SUBUNIT |
| W-09.06 | RED PASS HYDRO SUBAREA | W-24.02 | YELLO LAKE HYDRO SUBUNIT |
| W-09.07 | VALLEJO HYDRO SUBAREA | W-24.03 | EAST TARRANT HYDRO SUBUNIT |
| W-09.08 | SHADOW HYDRO SUBAREA | W-24.04 | JOHN HYDRO SUBUNIT |
| W-09.09 | FURNACE CREEK HYDRO SUBUNIT | W-25.00 | ANTIFLOP HYDRO UNIT |
| W-09.10 | FURNACE CREEK HYDRO SUBAREA | W-25.01 | ANTIFLOP HYDRO SUBUNIT |
| W-09.11 | GREENWATER HYDRO SUBAREA | W-25.02 | HAVER HYDRO SUBAREA |
| W-09.12 | AMARGOSA HYDRO SUBUNIT | W-25.03 | GLOSTER HYDRO SUBAREA |
| W-09.13 | VALLEJO HYDRO SUBAREA | W-25.04 | WILLOW SPRINGS HYDRO SUBAREA |
| W-09.14 | AMARGOSA HYDRO SUBAREA | W-25.05 | NEENACH HYDRO SUBAREA |
| W-09.15 | AMARGOSA HYDRO SUBAREA | W-25.06 | LANCASTER HYDRO SUBAREA |
| W-09.16 | AMARGOSA HYDRO SUBAREA | W-25.07 | NORTH MOUNT HYDRO SUBAREA |
| W-09.17 | AMARGOSA HYDRO SUBAREA | W-25.08 | BUTTE HYDRO SUBAREA |
| W-09.18 | AMARGOSA HYDRO SUBAREA | W-25.09 | BOX CREEK HYDRO SUBAREA |
| W-10.00 | PANAMINT HYDRO UNIT | W-26.00 | CLONERACK HYDRO UNIT |
| W-11.00 | MEQUITE HYDRO UNIT | W-26.01 | MOJAVE HYDRO UNIT |
| W-12.00 | IVANPAH HYDRO UNIT | W-26.02 | TEHACHA HYDRO SUBUNIT |
| W-13.00 | OWENSHEAD HYDRO UNIT | W-26.03 | UPPER MOJAVE HYDRO SUBUNIT |
| W-13.01 | LOST LAKE HYDRO SUBUNIT | W-26.04 | MIDDLE MOJAVE HYDRO SUBUNIT |
| W-13.02 | OWENSHEAD HYDRO SUBUNIT | W-26.05 | HARPER HYDRO SUBUNIT |
| W-14.00 | LEATH HYDRO UNIT | W-26.06 | GRASS VALLEY HYDRO SUBAREA |
| W-15.00 | NEELSON HYDRO UNIT | W-26.07 | HARPER HYDRO SUBAREA |
| W-15.01 | NEELSON HYDRO SUBUNIT | W-26.08 | LOWER MOJAVE HYDRO SUBUNIT |
| W-15.02 | NEELSON HYDRO SUBUNIT | W-26.09 | TROY HYDRO SUBUNIT |
| W-16.00 | RITZYFLE HYDRO UNIT | W-26.10 | YANE WASH HYDRO SUBAREA |
| W-17.00 | GOLDSTONE HYDRO UNIT | W-26.11 | TROY HYDRO SUBAREA |
| W-18.00 | FOYITE HYDRO UNIT | W-26.12 | AFION HYDRO SUBUNIT |
| W-19.00 | SUPERIOR HYDRO UNIT | W-26.13 | FAVES HYDRO SUBAREA |
| | | W-26.14 | SPRING HYDRO SUBAREA |
| | | W-26.15 | LANGFORD HYDRO SUBAREA |
| | | W-26.16 | RAKER HYDRO SUBUNIT |
| | | W-26.17 | SILVER LAKE HYDRO SUBAREA |
| | | W-26.18 | SODA LAKE HYDRO SUBAREA |
| | | W-26.19 | YELLO HYDRO SUBUNIT |
| | | W-26.20 | BROADWELL HYDRO UNIT |

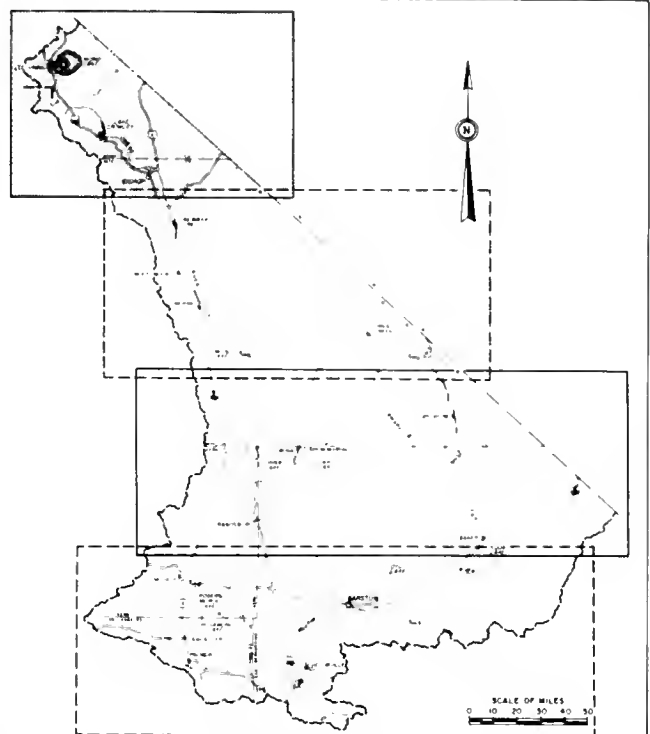


STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT
SOUTHERN LAHONTAN AREA
LAND AND WATER USE SURVEY, 1961
HYDROLOGIC UNITS, SUBUNITS,
AND SUBAREAS
SCALE OF MILES
0 10 20 30
1965

AREAL DESCRIPTION
HYDROLOGIC

LAHONTAN DRAINAGE

- W-01 MONO
- W-02 ADOBE
- W-03 OWENS
- W-04 FISH LAKE
- W-05 DEEP
- W-06 EUREKA
- W-07 SALINE
- W-08 RACE
- W-09 AMARGOSA
- W-10 PAHRUMP
- W-11 MESQUITE
- W-12 IVANPA
- W-13 OWLSHAW
- W-14 LEACH
- W-15 NELSON
- W-16 BICYCLE
- W-17 GOLDS
- W-18 COYOTE
- W-19 SUPERIOR
- W-20 PANAMA
- W-21 SEARLES
- W-22 COSO
- W-23 UPPER
- W-24 INDIAN
- W-25 FREMONT
- W-26 ANTELOPE
- W-27 CUDE
- W-28 MOJAVE
- W-29 BROAD



LOCATION MAP

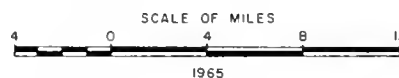
LEGEND

- BOUNDARY OF INVESTIGATIONAL AREA
- BOUNDARY OF HYDROLOGIC UNIT
- BOUNDARY OF FEDERAL AND STATE LANDS
- IRRIGATED AGRICULTURE
- URBAN RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL-MANUFACTURING AND PROCESSING
- INDUSTRIAL-EXTRACTIVE, STORAGE, AND TRANSPORTATION
- RECREATIONAL RESIDENTIAL
- W-05 DRAINAGE PROVINCE (W) AND HYDROLOGIC UNIT DESIGNATION

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

SOUTHERN LAHONTAN AREA
LAND AND WATER USE SURVEY, 1961

PRESENT LAND USE

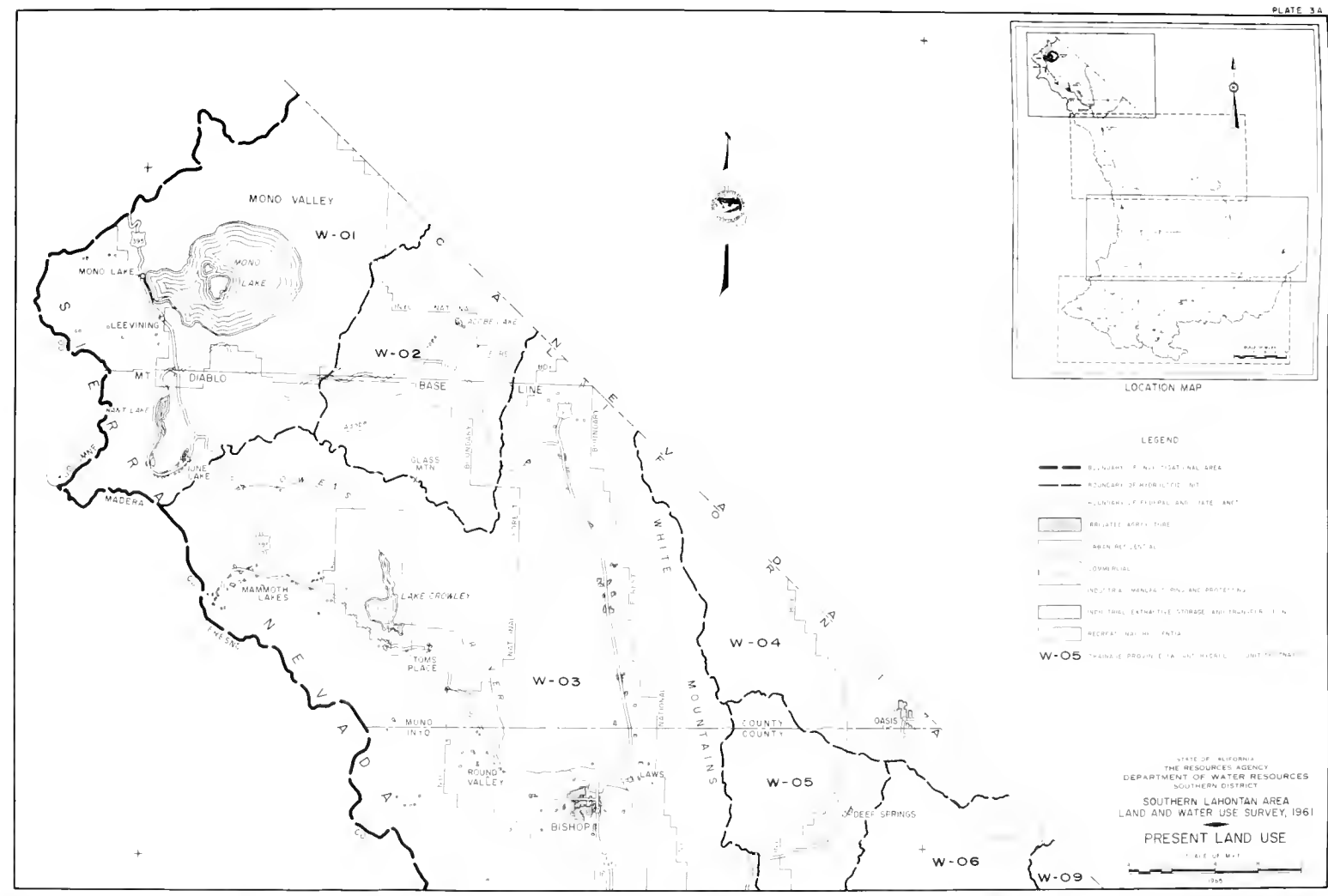


W-09

AREAL DESIGNATIONS
HYDROLOGIC UNITS

LAHONTAN DRAINAGE PROVINCE

- W-01 MONO HYDROLOGIC UNIT
- W-02 ADOLBE HYDROLOGIC UNIT
- W-03 OWENS HYDROLOGIC UNIT
- W-04 FISH LAKE HYDROLOGIC UNIT
- W-05 DEEP SPRINGS HYDROLOGIC UNIT
- W-06 EUREKA HYDROLOGIC UNIT
- W-07 SALINE HYDROLOGIC UNIT
- W-08 RACE TRACK HYDROLOGIC UNIT
- W-09 AMARGOSA HYDROLOGIC UNIT
- W-10 PANRUMP HYDROLOGIC UNIT
- W-11 MESQUITE HYDROLOGIC UNIT
- W-12 IVANPAH HYDROLOGIC UNIT
- W-13 OWLSHEAD HYDROLOGIC UNIT
- W-14 LEACH HYDROLOGIC UNIT
- W-15 NELSON HYDROLOGIC UNIT
- W-16 BICYCLE HYDROLOGIC UNIT
- W-17 GOLDSTONE HYDROLOGIC UNIT
- W-18 COYOTE HYDROLOGIC UNIT
- W-19 SUPERIOR HYDROLOGIC UNIT
- W-20 PANAMINT HYDROLOGIC UNIT
- W-21 SEARLES HYDROLOGIC UNIT
- W-22 COSO HYDROLOGIC UNIT
- W-23 UPPER CACTUS HYDROLOGIC UNIT
- W-24 INDIAN WELLS HYDROLOGIC UNIT
- W-25 FREMONT HYDROLOGIC UNIT
- W-26 ANTELOPE HYDROLOGIC UNIT
- W-27 CUDEBACH HYDROLOGIC UNIT
- W-28 MOJAVE HYDROLOGIC UNIT
- W-29 BROADWELL HYDROLOGIC UNIT



2000-01-01 (13)

2000-01-01 (13)

2000-01-01 (13)

2000-01-01 (13)

2000-01-01

2000-01-01 (13)

2000-01-01

2000-01-01

2000-01-01

2000-01-01 (13)

2000-01-01 (13)

2000-01-01

2000-01-01

2000-01-01

2000-01-01

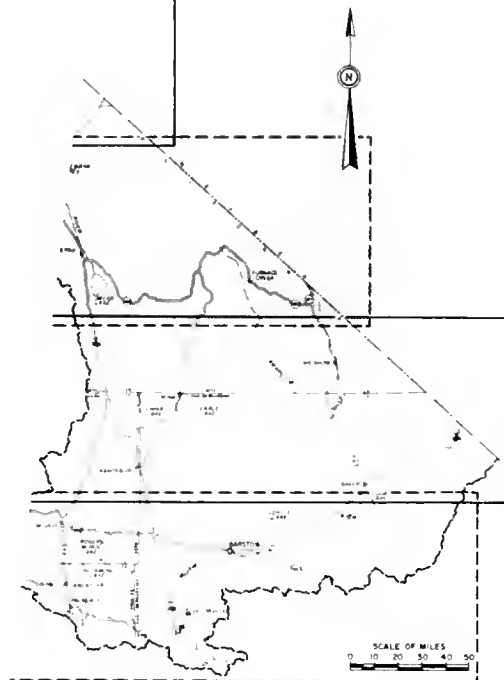
2000-01-01

2000-01-01

AREAL DESIGNATION
HYDROLOGIC

LAHONTAN DRAINAGE

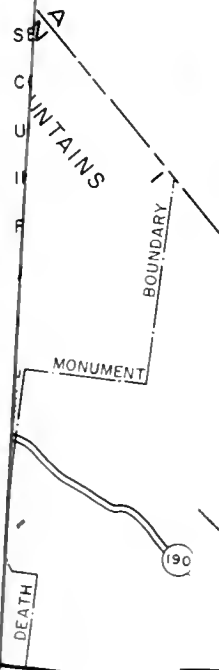
- W-01 MONO H
- W-02 ADOBE
- W-03 OWENS
- W-04 FISH L
- W-05 DEEP
- W-06 EUREKA
- W-07 SALINE
- W-08 RACE
- W-09 AMAR
- W-10 PAHR
- W-11 MESQ
- W-12 IVAN
- W-13 OWL
- W-14 LEA
- W-15 NEL
- W-16 BIC
- W-17 GO
- W-18 CO
- W-19 SU
- W-20 PA
- W-21 SEL
- W-22 C
- W-23 U
- W-24 I
- W-25 F
- W-26
- W-27
- W-28
- W-29



LOCATION MAP

LEGEND

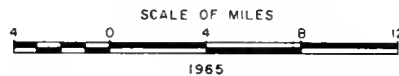
- BOUNDARY OF INVESTIGATIONAL AREA
- BOUNDARY OF HYDROLOGIC UNIT
- BOUNDARY OF FEDERAL AND STATE LANDS
- IRRIGATED AGRICULTURE
- URBAN RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL-MANUFACTURING AND PROCESSING
- INDUSTRIAL-EXTRACTIVE, STORAGE, AND TRANSPORTATION
- RECREATIONAL RESIDENTIAL
- V-09 DRAINAGE PROVINCE (W) AND HYDROLOGIC UNIT DESIGNATION



STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

SOUTHERN LAHONTAN AREA
LAND AND WATER USE SURVEY, 1961

PRESENT LAND USE



2. The first part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

$$f(x) = \int_0^x f(t) dt + \int_0^x f(t) f'(t) dt.$$

It is shown that the function $f(x)$ is continuous and differentiable on the interval $[0, 1]$.

The second part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

$$f(x) = \int_0^x f(t) dt + \int_0^x f(t) f'(t) dt + \int_0^x f(t) f''(t) dt.$$

It is shown that the function $f(x)$ is continuous and differentiable on the interval $[0, 1]$.

The third part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

$$f(x) = \int_0^x f(t) dt + \int_0^x f(t) f'(t) dt + \int_0^x f(t) f''(t) dt + \int_0^x f(t) f'''(t) dt.$$

It is shown that the function $f(x)$ is continuous and differentiable on the interval $[0, 1]$.

The fourth part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

$$f(x) = \int_0^x f(t) dt + \int_0^x f(t) f'(t) dt + \int_0^x f(t) f''(t) dt + \int_0^x f(t) f'''(t) dt + \int_0^x f(t) f^{(4)}(t) dt.$$

It is shown that the function $f(x)$ is continuous and differentiable on the interval $[0, 1]$.

The fifth part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

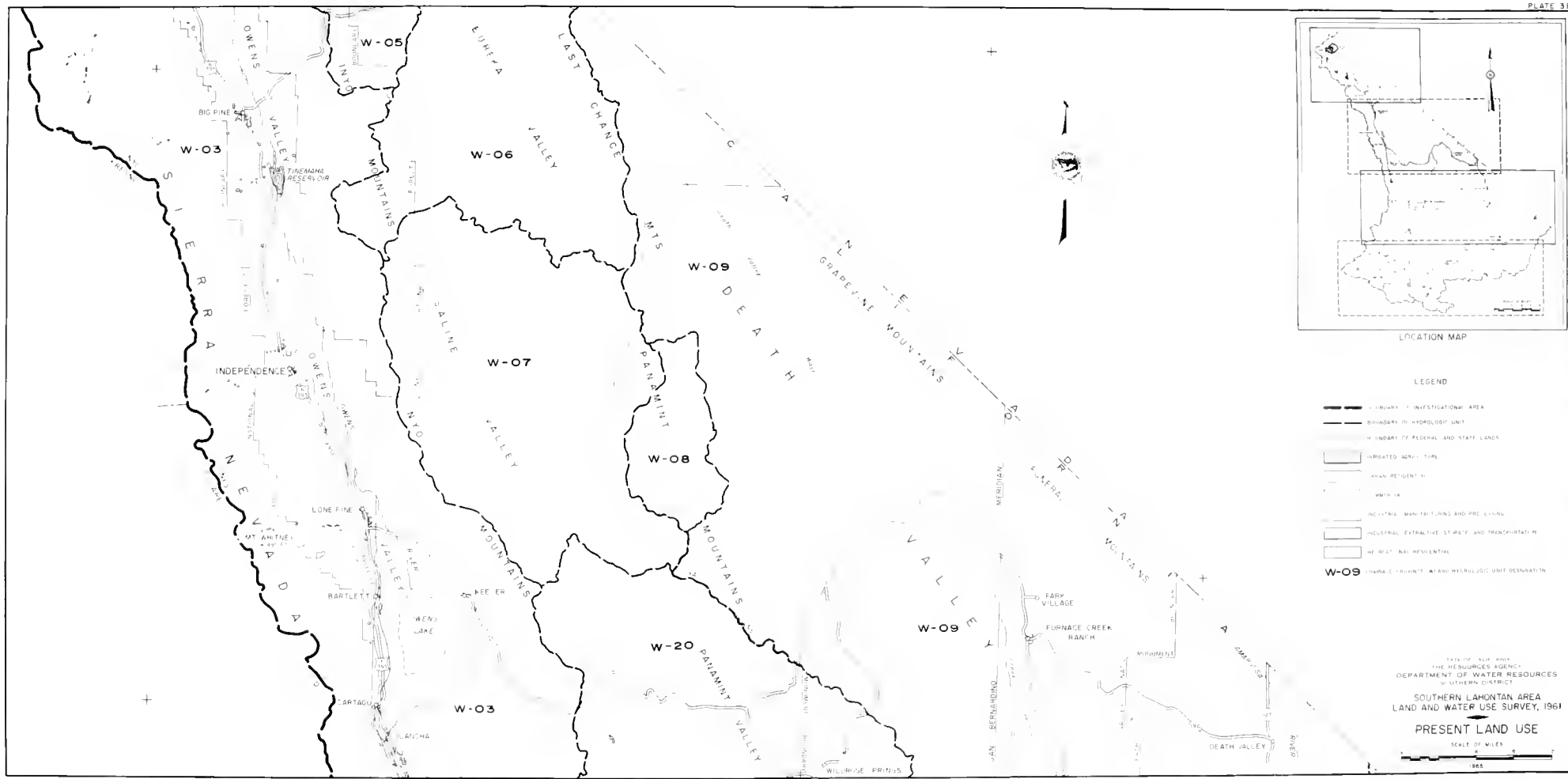
$$f(x) = \int_0^x f(t) dt + \int_0^x f(t) f'(t) dt + \int_0^x f(t) f''(t) dt + \int_0^x f(t) f'''(t) dt + \int_0^x f(t) f^{(4)}(t) dt + \int_0^x f(t) f^{(5)}(t) dt.$$

It is shown that the function $f(x)$ is continuous and differentiable on the interval $[0, 1]$.

AREAL DESIGNATIONS HYDROLOGIC UNITS










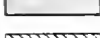
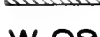
LAHONTAN ORAINAGE PROVINCE

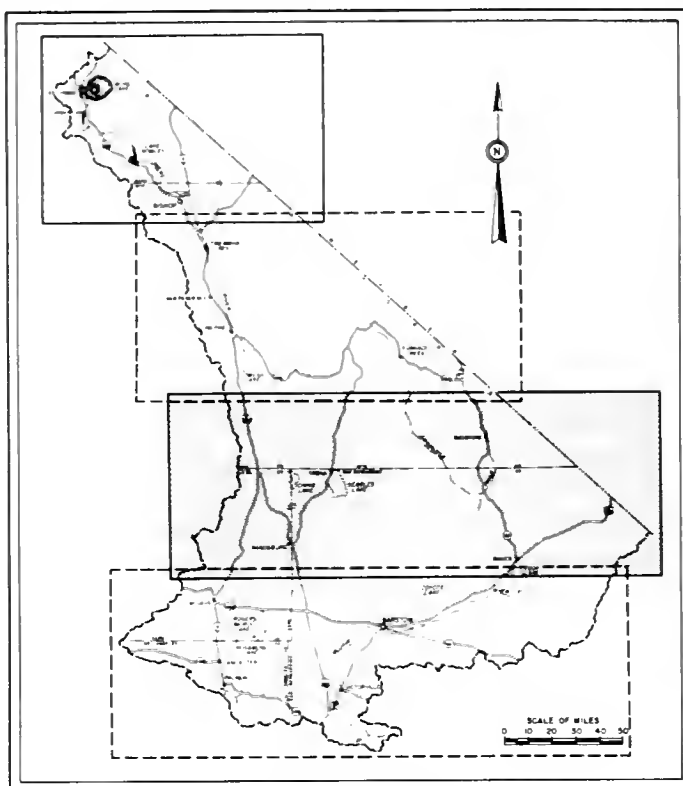
- W-01 MOND HYDROLOGIC UNIT
- W-02 ADOBE HYDROLOGIC UNIT
- W-03 OWENS HYDROLOGIC UNIT
- W-04 FISH LAKE HYDROLOGIC UNIT
- W-05 DEEP SPRINGS HYDROLOGIC UNIT
- W-06 EUREKA HYDROLOGIC UNIT
- W-07 SALINE HYDROLOGIC UNIT
- W-08 RACE TRACK HYDROLOGIC UNIT
- W-09 AMARODSA HYDROLOGIC UNIT
- W-10 PANRUMP HYDROLOGIC UNIT
- W-11 MESQUITE HYDROLOGIC UNIT
- W-12 IVANPAH HYDROLOGIC UNIT
- W-13 OWLSHEAD HYDROLOGIC UNIT
- W-14 LEACH HYDROLOGIC UNIT
- W-15 NELSON HYDROLOGIC UNIT
- W-16 BICYCLE HYDROLOGIC UNIT
- W-17 GOLDSTONE HYDROLOGIC UNIT
- W-18 COYOTE HYDROLOGIC UNIT
- W-19 SUPERIOR HYDROLOGIC UNIT
- W-20 PANAMINT HYDROLOGIC UNIT
- W-21 SEARLES HYDROLOGIC UNIT
- W-22 COSO HYDROLOGIC UNIT
- W-23 UPPER CACTUS HYDROLOGIC UNIT
- W-24 INDIAN WELLS HYDROLOGIC UNIT
- W-25 FREMONT HYDROLOGIC UNIT
- W-26 ANTELOPE HYDROLOGIC UNIT
- W-27 CUDEBACK HYDROLOGIC UNIT
- W-28 MOJAVE HYDROLOGIC UNIT
- W-29 BROADWELL HYDROLOGIC UNIT



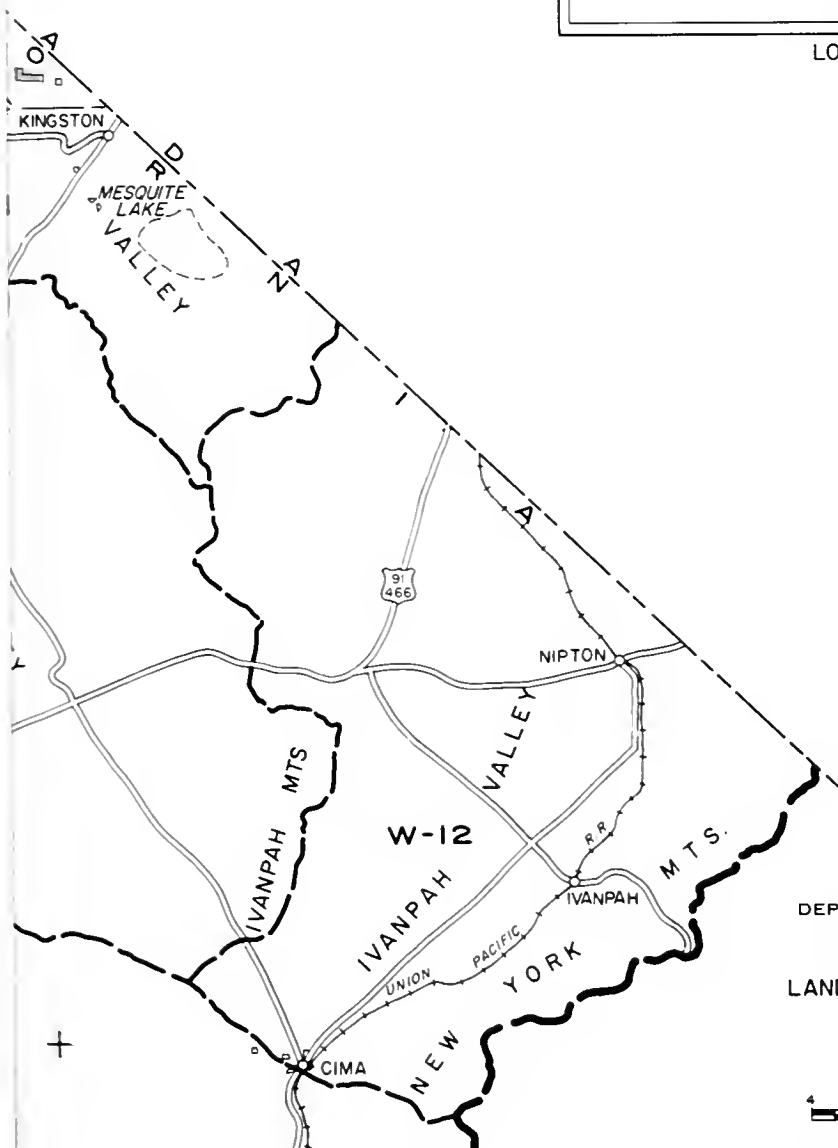
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SOUTHERN LAHONTAN AREA
LAND AND WATER USE SURVEY, 1961
PRESENT LAND USE
SCALE OF MILES
0 10 20 30 40 50 60 70 80 90 100

LEGEND

-  BOUNDARY OF INVESTIGATIONAL AREA
 -  BOUNDARY OF HYDROLOGIC UNIT
 -  BOUNDARY OF FEDERAL AND STATE LANDS
 -  IRRIGATED AGRICULTURE
 -  URBAN RESIDENTIAL
 -  URBAN RESIDENTIAL-LESS THAN 10 PERCENT DEVELOPED
 -  COMMERCIAL
 -  INDUSTRIAL-MANUFACTURING AND PROCESSING
 -  INDUSTRIAL-EXTRACTIVE, STORAGE, AND TRANSPORTATION
 -  RECREATIONAL RESIDENTIAL
 -  MILITARY RESERVATIONS
- W-09** DRAINAGE PROVINCE (W) AND HYDROLOGIC UNIT DESIGNATION



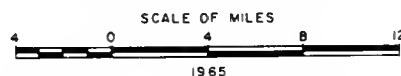
LOCATION MAP



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SOUTHERN LAHONTAN AREA
LAND AND WATER USE SURVEY, 1961

PRESENT LAND USE

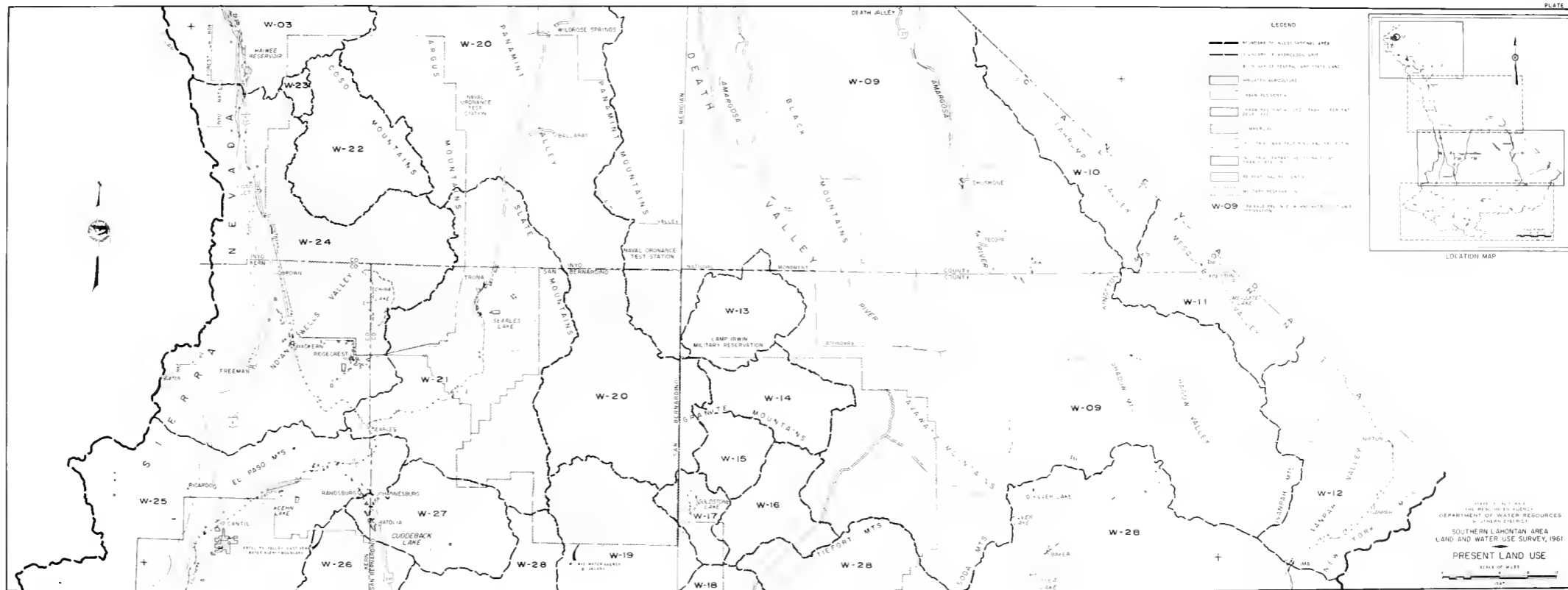


1965



LAHONTAN DRAINAGE PROVINCE

- W-29 BROADWELL HYDROLOGIC UNIT



1945
1946

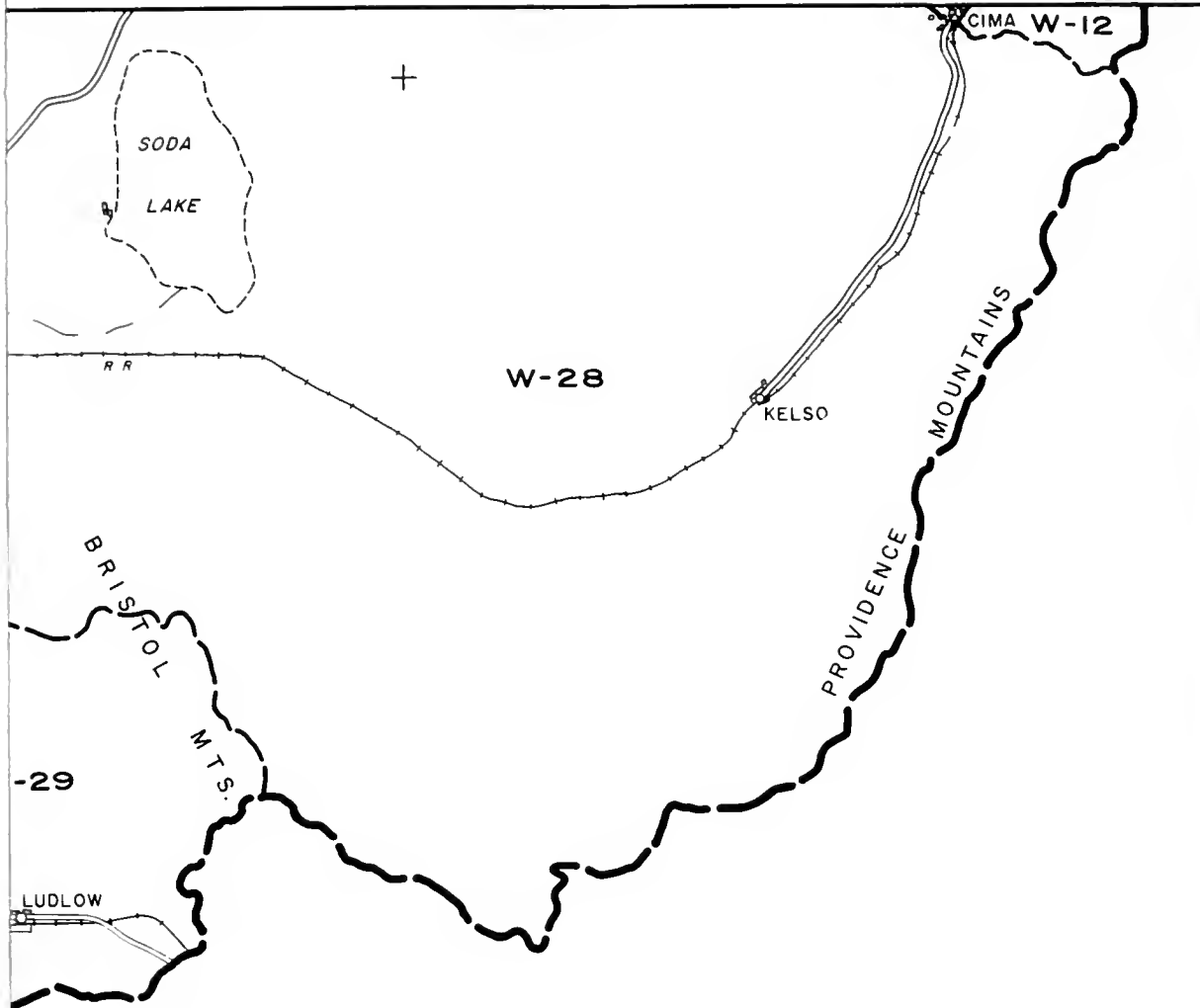
1947

1948

1949

1950

1951



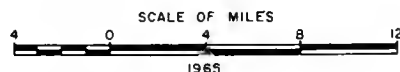
LEGEND

- BOUNDARY OF INVESTIGATIONAL AREA
- BOUNDARY OF HYDROLOGIC UNIT
- BOUNDARY OF FEDERAL AND STATE LANDS
- IRRIGATED AGRICULTURE
- URBAN RESIDENTIAL
- URBAN RESIDENTIAL - LESS THAN 10 PERCENT DEVELOPED
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- DRAINAGE PROVINCE (W) AND HYDROLOGIC UNIT DESIGNATION

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SOUTHERN LAHONTAN AREA
LAND AND WATER USE SURVEY, 1961

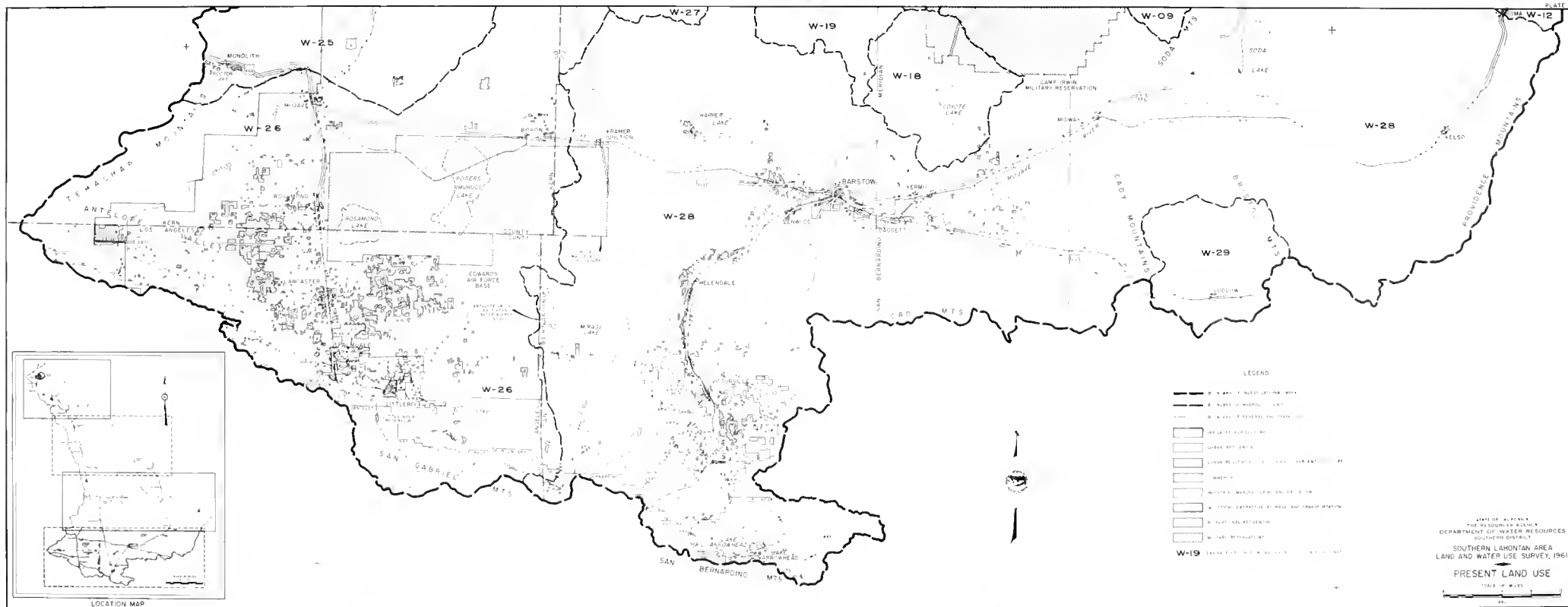
PRESENT LAND USE

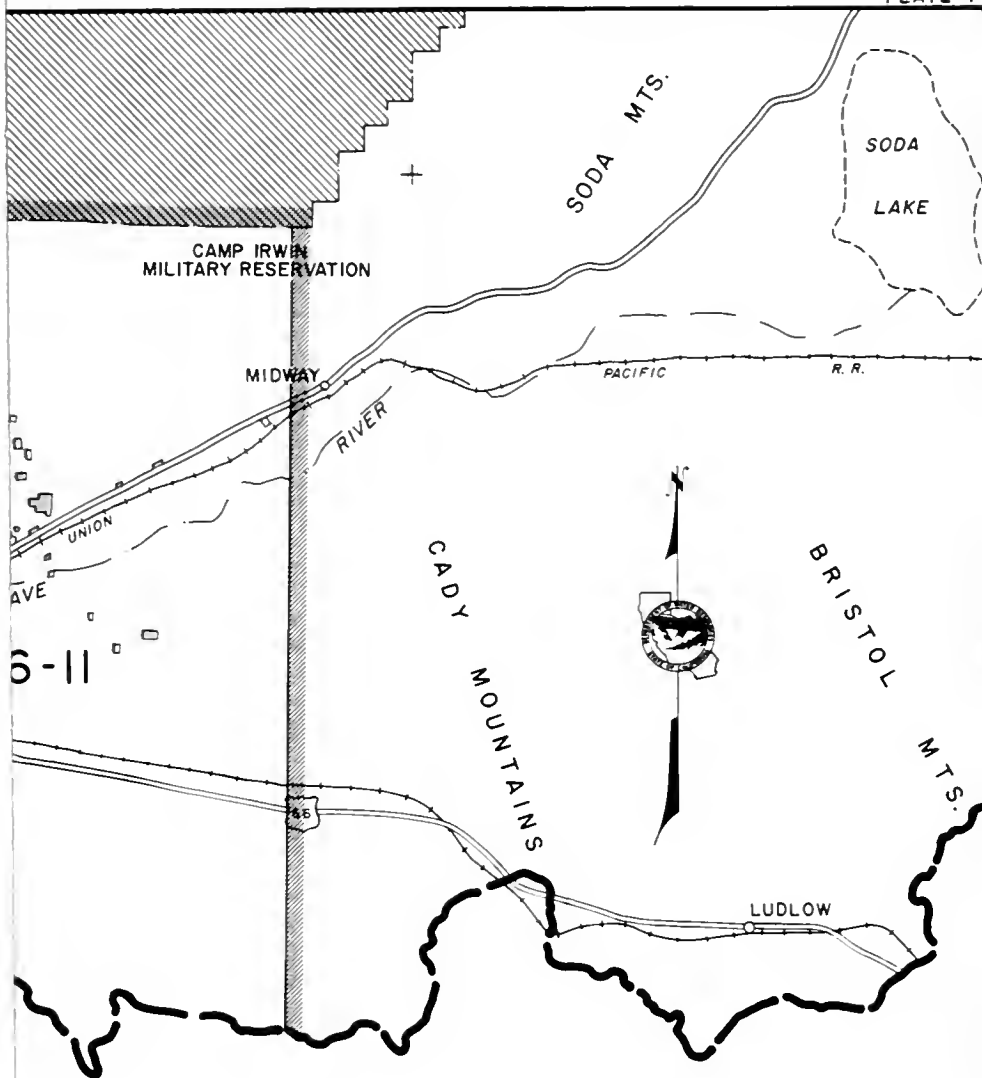


AREAL DESIGNATIONS HYDROLOGIC UNITS

LAHONTAN DRAINAGE PROVINCE

- W-01 MONO HYDROLOGIC UNIT
- W-02 ADOBE HYDROLOGIC UNIT
- W-03 OWENS HYDROLOGIC UNIT
- W-04 FISH LAKE HYDROLOGIC UNIT
- W-05 DEER SPRINGS HYDROLOGIC UNIT
- W-06 EUREKA HYDROLOGIC UNIT
- W-07 SALINE HYDROLOGIC UNIT
- W-08 RACE TRACK HYDROLOGIC UNIT
- W-09 AMARGOSA HYDROLOGIC UNIT
- W-10 PAHRUMP HYDROLOGIC UNIT
- W-11 MESQUITE HYDROLOGIC UNIT
- W-12 IVANPAH HYDROLOGIC UNIT
- W-13 OWLSHEAD HYDROLOGIC UNIT
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- W-24 INDIAN WELLS HYDROLOGIC UNIT
- W-25 FREMONT HYDROLOGIC UNIT
- W-26 ANTELOPE HYDROLOGIC UNIT
- W-27 CUDEBACK HYDROLOGIC UNIT
- W-28 MOJAVE HYDROLOGIC UNIT
- W-29 BROADWELL HYDROLOGIC UNIT





END

VESTIGATIONAL AREA

DROGRAPHIC UNIT

DERAL AND STATE LANDS

NOT AVAILABLE

LTURAL EXPANSION

RBAN EXPANSION

AL EXPANSION
(OPMENT IS LESS THAN 10 PERCENT)

SIDENTIAL EXPANSION

LTURE TO NON-IRRIGATED USE

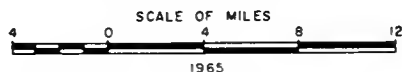
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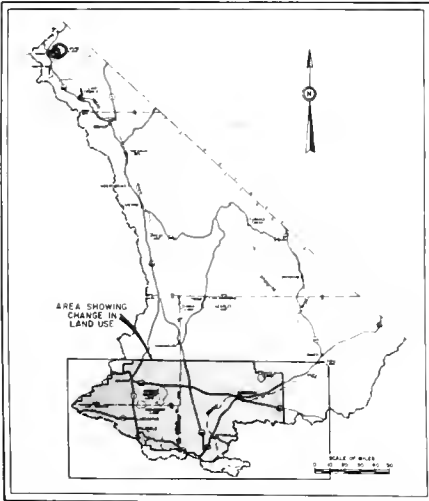
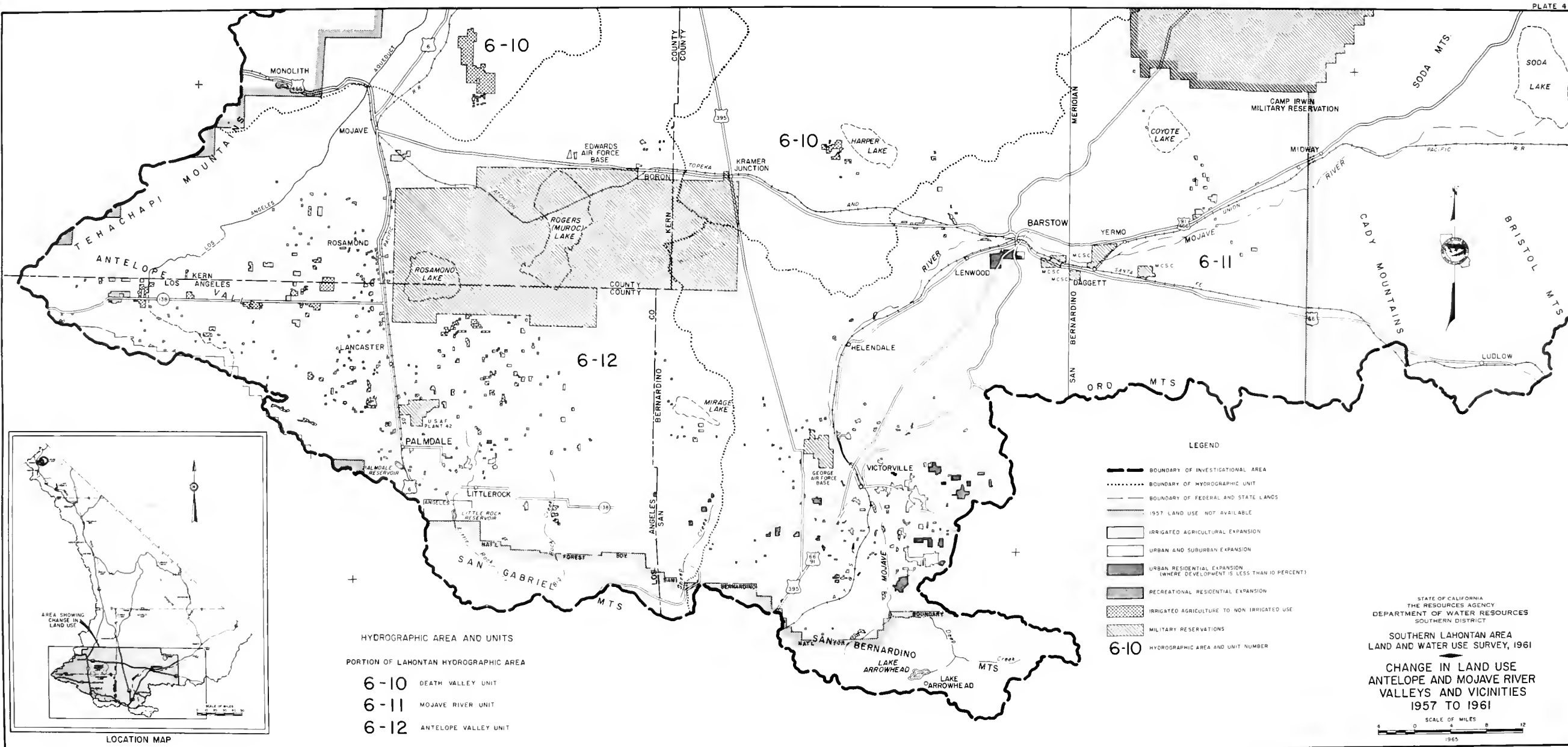
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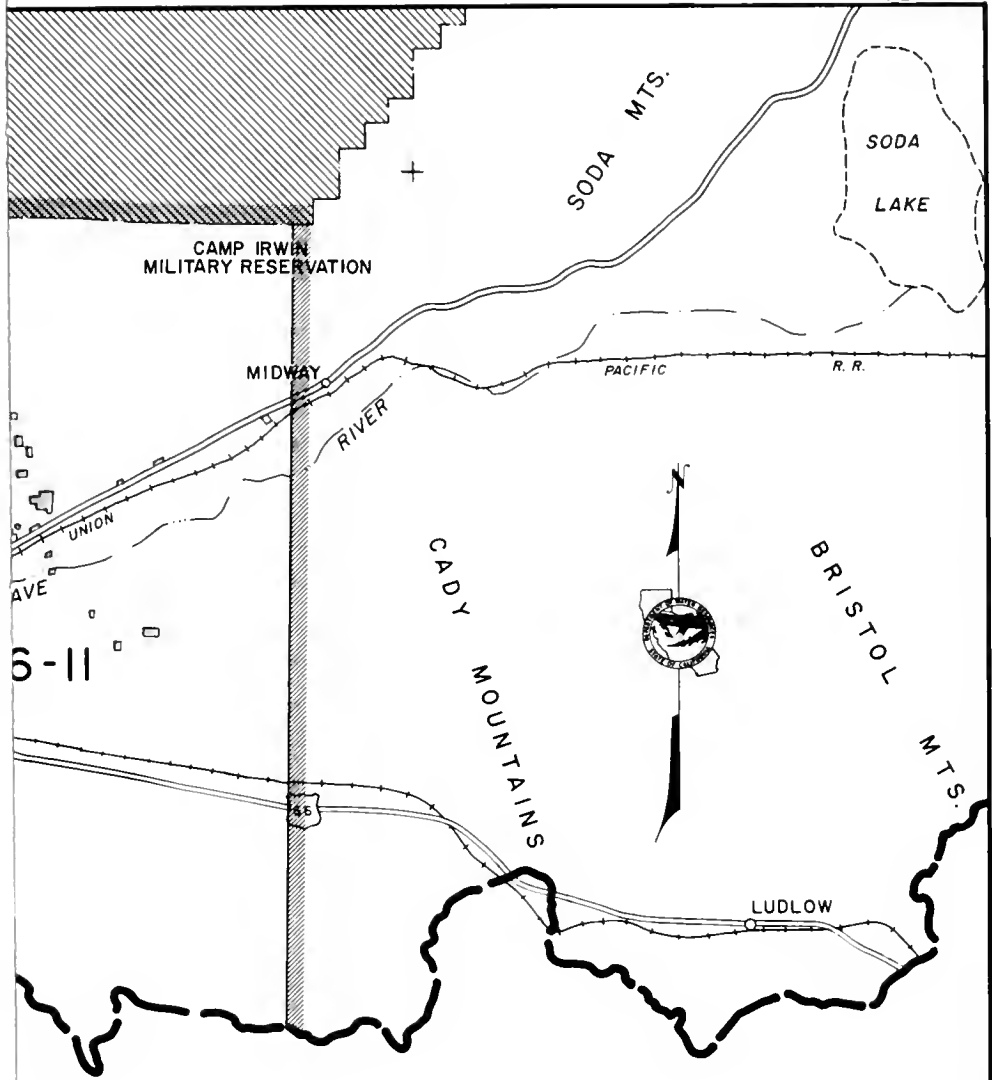
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LAND AND WATER USE SURVEY, 1961

CHANGE IN LAND USE
ANTELOPE AND MOJAVE RIVER
VALLEYS AND VICINITIES
1957 TO 1961





LOCATION MAP



6-11

END

VESTIGATIONAL AREA

DROGRAPHIC UNIT

DERAL AND STATE LANDS

NOT AVAILABLE

LTURAL EXPANSION

RBAN EXPANSION

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SIDENTIAL EXPANSION

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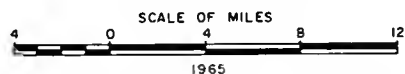
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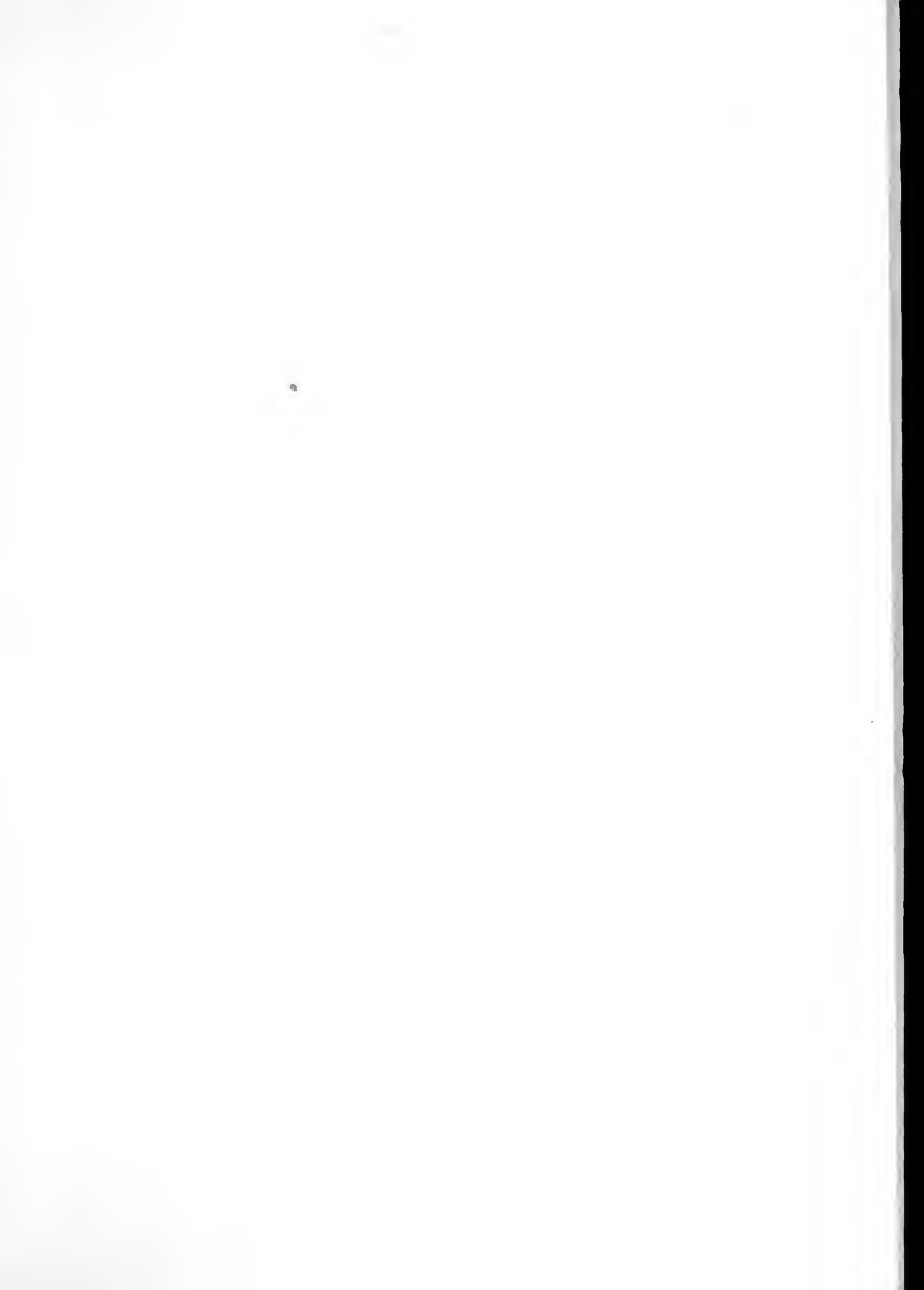
EA AND UNIT NUMBER

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SOUTHERN DISTRICT

SOUTHERN LAHONTAN AREA
LAND AND WATER USE SURVEY, 1961

CHANGE IN LAND USE
ANTELOPE AND MOJAVE RIVER
VALLEYS AND VICINITIES
1957 TO 1961





21



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